Software Engineering Institute

Wireless Emergency Alerts: Trust Model Technical Report

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Executive Summary

The Wireless Emergency Alerts (WEA) service, formerly known as the Commercial Mobile Alert Service (CMAS), enhances public safety by providing authorized emergency management agencies (EMAs) with the capability to issue alerts and warnings to mobile communication devices (e.g., cell phones) in a designated geographic area. WEA is a component of the Integrated Public Alert and Warning System (IPAWS) operated by the Federal Emergency Management Agency (FEMA) in cooperation with the Federal Communications Commission (FCC) and supported by the Department of Homeland Security Science and Technology Directorate (DHS S&T). Three categories of WEA messages may be sent: Presidential Alerts, for events of critical importance to the nation; Imminent Threat Alerts, for threats arising from weather and other hazards; and Americas Missing: Broadcast Emergency Response Alerts, for missing children.

Trust is a key factor in the effectiveness of the WEA service. Alert originators (AOs) at EMAs must trust WEA to deliver alerts to the public in an accurate and timely manner. Absent this trust, AOs will not use WEA. Members of the public must also trust the WEA service. They must understand and believe the messages that they receive before they will act on them. Clearly, FEMA, the EMAs, and the AOs must all strive to maximize and maintain trust in the WEA service if it is to be an effective alerting tool.

In 2012, DHS S&T tasked the Carnegie Mellon® Software Engineering Institute (SEI) with developing a WEA trust model. The purpose of this model was to provide data for FEMA that would enable it to maximize the effectiveness of WEA and provide guidance for AOs that would support them in using WEA in a manner that maximized public safety. Our approach to this task was to

1. build models that could predict the levels of AO trust and public trust in specific scenarios
2. validate these models using data collected from AOs and the public
3. execute simulations on these models for numerous scenarios to identify
    a. recommendations to AOs and/or FEMA for actions to take that increase trust
    b. recommendations to AOs and/or FEMA for actions to avoid that decrease trust

Results of this work consist of

1. a detailed technical report (this report) describing the process employed in the development and validation of the trust models and the resulting structure and functionality of the models
2. *Trust Model Simulations for the Wireless Emergency Alerts (WEA) Service*, a report detailing the scenarios and simulations executed on the trust models [Morrow 2013]
3. *Maximizing Trust in the Wireless Emergency Alerts (WEA) Service*, a recommendations report analyzing the results of the simulations and identifying trust-enhancing practices to be employed and trust-degrading processes to be avoided by both AOs and FEMA [Woody 2013]

This project began with a review of the literature addressing issues of trust in public alerting. As a result of this review, we adjusted the project scope to focus primarily on “trust” factors considered within the influence or control of WEA system operators and AOs. We realized that most, if not all, potential factors associated with trust in the WEA system would be subjective in nature. This realization suggested the use of Bayesian belief networks (BBNs) to model trust. It also suggested that we would need to perform extensive data collection through interviews and surveys of AOs and representatives of the public who would be receiving these alerts. To facilitate this data collection, we approached the CMU Office of Research Integrity and Compliance for guidance and approval with regard to the human-subject research aspects of the WEA trust model development. The literature review enabled the development of an interview script containing 25 interview questions, which were then administered to 17 emergency alert organizations.

From these initial interviews, we identified 56 preliminary factors as potentially influential on the public's and/or AOs' trust in the WEA system. Using cause–effect mapping tables, we consolidated the trust factor lists into a more manageable list of 27 trust factors for the public trust model and 35 trust factors for the AO trust model. Armed with the list of trust factors for each model, we then developed surveys to canvas members of the public and AO communities for their responses to hypothetical alert message scenarios. Consequently, we developed three surveys of approximately 19 questions each to administer to equal subsets of approximately 5,000 members of the public. We also developed three surveys of approximately 12 questions each to administer to equal subsets of approximately 560 AOs. After subjecting the data collected from the surveys to statistical analysis involving hypothesis testing and linear regression modeling, we concluded that only 7 of the relationships in the public trust model were statistically significant at the 5% level while 29 of the relationships in the AO trust model were statistically significant at the 5% level. That does not mean that the remaining relationships did not influence trust; it means that we need more survey data to achieve a larger sample than we were able to collect. Such a sample would reduce the measurement noise and enable us to determine the relationship.

Once we had developed the models, we exercised each with a series of scenarios addressing all of the model inputs and outputs. We also presented these same scenarios to panels composed of representatives of the public and alerting subject-matter experts. For each BBN model, we related the probability predictions of trust outcomes to the results from corresponding validation scenarios. The result was a collection of linear regression equations that capably "calibrate" the BBN predictions to final validation scenario results, as shown in Figure 1.

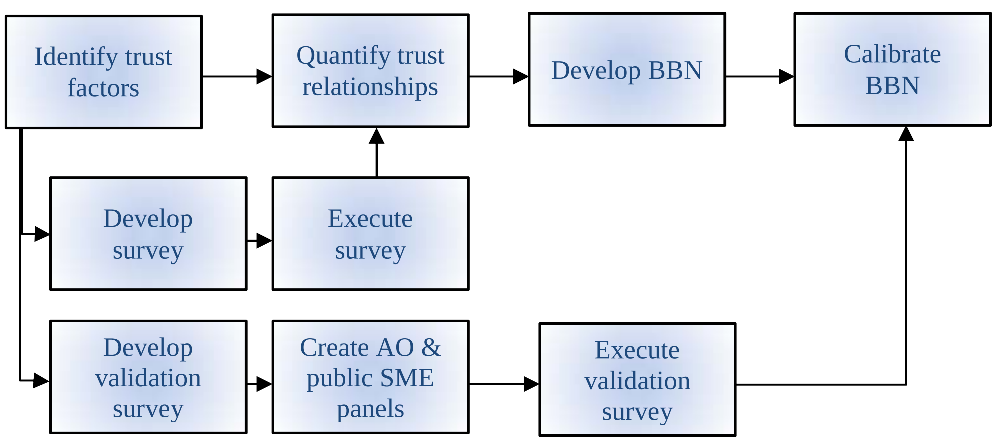

Figure 1: Trust Model Validation Process

We expected such a transform to be necessary because the BBN models were populated based on 1:1 factor assessments and ignored possible factor interactions. Hence, the regression equations used to transform the BBN prediction probabilities account for both missing interaction effects and measurement error associated with the small sample of validation scenario evaluations. In the final analysis, the BBN trust models facilitated the operational analysis of additional and unprecedented scenarios in support of a separate effort to develop guidance for AOs and WEA system operators concerned with trust in the WEA system. We also identified opportunities for future research that could leverage the operational nature of the BBN trust models in AgenaRisk, namely, the conduct of observational research into the trust factors, making use of the learning mechanisms possible within BBN models.

Abstract

Trust is a key factor in the effectiveness of the Wireless Emergency Alerts (WEA) service. Alert originators (AOs) must trust WEA to deliver alerts to the public in an accurate and timely manner. Members of the public must also trust the WEA service before they will act on the alerts that they receive. This research aimed to develop a trust model to enable the Federal Emergency Management Agency (FEMA) to maximize the effectiveness of WEA and provide guidance for AOs that would support them in using WEA in a manner that maximizes public safety. The research method included Bayesian belief networks to model trust in WEA because they enable reasoning about and modeling of uncertainty. The research approach was to build models that could predict the levels of AO trust and public trust in specific scenarios, validate these models using data collected from AOs and the public, and execute simulations on these models for numerous scenarios to identify recommendations to AOs and FEMA for actions to take that increase trust and actions to avoid that decrease trust. This report describes the process used to develop and validate the trust models and the resulting structure and functionality of the models.

1 Introduction

1.1 Background

The Wireless Emergency Alerts (WEA) service, formerly known as the Commercial Mobile Alert Service (CMAS), enhances public safety by providing authorized emergency management agencies (EMAs) with the capability to issue alerts and warnings to mobile communication devices (e.g., cell phones) in a designated geographic area. WEA is a component of the Integrated Public Alert and Warning System (IPAWS) operated by the Federal Emergency Management Agency (FEMA) in cooperation with the Federal Communications Commission (FCC) and supported by the Department of Homeland Security Science and Technology Directorate (DHS S&T).

WEA messages may be initiated by authorized national, state, local, tribal, and territorial EMAs. Three categories of WEA messages may be sent:

1. Presidential – Only the president of the United States can issue a Presidential Alert. This message enables the president to alert or warn a specific region, or the nation as a whole, of an event of critical importance.
2. Imminent Threat – EMAs may issue alerts to specific geographic areas affected by an immediate or expected threat of extreme or severe consequences. Threats may arise from a number of sources, including weather conditions (e.g., tornadoes, flash floods), law enforcement actions (e.g., riots, gunfire), fires, and environmental hazards (e.g., chemical spills, gas releases).
3. Americas Missing: Broadcast Emergency Response (AMBER) – EMAs may issue AMBER Alerts for missing or abducted children.

WEA messages are initiated by the EMAs and transmitted to the IPAWS Open Platform for Emergency Networks (IPAWS-OPEN) system using the Common Alerting Protocol (CAP) format. After authentication and verification, IPAWS-OPEN processes the WEA message and sends it to the commercial mobile service providers (CMSPs) participating in the WEA service. The CMSPs broadcast the alert from cell towers in the area to all compatible cellular devices. The cellular devices produce a distinctive ringtone, vibration pattern, or both and display the WEA message.

1.2 Problem Statement

Trust is a key factor in the effectiveness of the WEA service. Alert originators (AOs) and EMA management must trust WEA to deliver alerts to the public in an accurate and timely manner. Absent this trust, AOs will not use WEA. Members of the public must also trust the WEA service. They must understand and believe the messages that they receive before they will act on them. Clearly, FEMA, the EMAs, and the AOs must all strive to maximize and maintain trust in the WEA service if it is to be an effective alerting tool.

In 2012, DHS S&T tasked the Carnegie Mellon® Software Engineering Institute (SEI) with developing a WEA trust model. The purpose of this model was to provide data for FEMA that would enable them to maximize the effectiveness of WEA and provide guidance for AOs that would support them in using WEA in a manner that maximized public safety. At a high level, our approach to this task was to

1. build models that could predict the levels of AO trust and public trust in specific scenarios
2. validate these models using data collected from AOs and the public
3. execute simulations on these models for numerous scenarios to identify
    a. recommendations to AOs and/or FEMA for actions to take that increase trust
    b. recommendations to AOs and/or FEMA for actions to avoid that decrease trust

Results of this work consist of

- a detailed technical report (this report) describing the process employed in the development and validation of the trust models and the resulting structure and functionality of the models
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1.3 Project Environment

1.3.1 Project Context

This task was conducted as part of a larger engagement between the SEI and DHS S&T. DHS S&T had contracted the SEI to perform a number of tasks focused on maximizing deployment of WEA. These tasks included

- development of an integration strategy providing guidance to EMAs and AOs in the adoption and deployment of WEA [SEI 2013a]
- development of a security strategy providing recommendations for FEMA to manage the cybersecurity of the WEA service and recommendations for AOs to manage the cybersecurity of their systems accessing the WEA service [SEI 2013b]
- development of documents to promote WEA adoption by AOs:
    - documentation of a 2011 demonstration of the WEA service in New York City [Trocki Stark 2013]
    - development and documentation of a collection of best practices addressing AO adoption and use of WEA [McGregor 2013]
    - development of a WEA trust model (this task)

A great deal of synergy existed between these tasks, enabling the SEI to share knowledge and resources to the benefit of all tasks.

1.3.2 Project Team

The project team consisted of members from the SEI and from SRA International, Inc. The SEI team members provided the necessary internal domain knowledge of WEA and supplemental experience with statistical analysis and probabilistic modeling. The SRA members contributed knowledge of previous workshops aimed at identifying trust factors along with access to an extensive list of emergency alert notification officials from across the United States.

The SEI was also assisted in this task by numerous EMA organizations, as noted in the Acknowledgements section, that provided both data and valuable insights into public alerting through participation in interviews, surveys, and other data collection vehicles.

1.4 Intended Audience

As noted earlier, this is one of three reports resulting from this work. This report is not specifically aimed at members of the alert origination community or at FEMA staff concerned with sustaining and improving the WEA service—that audience will be addressed by the report *Maximizing Trust in the Wireless Emergency Alerts (WEA) Service* [Woody 2013].

This report targets an audience who wants to understand the process of developing and using trust models. This audience is likely to include

- researchers who wish to understand, develop, or use trust models in public alerting, or any other domain
- public alerting researchers who wish to understand, use, or expand on the work contained herein

Therefore, this report addresses only the trust model development process and the trust models themselves. It does not address the use of the models to execute simulations or the findings from the analyses of these simulations. These topics are contained in the other reports.

2 Challenge

During the initial planning for this project, we wrestled with the challenge of modeling factors related to both the public's and the AO's trust in the WEA system. Due to the subjective nature of these factors, we concentrated on probabilistic modeling as an attractive method to combine the expected historical data from research into emergency notification systems with more subjective data derived from expert opinion. The plan that we implemented resulted in a unified model that enabled simultaneous evaluation of the effects of many driving factors on outputs representative of trust. This construct supported the need to evaluate a wide variety of scenarios to develop guidance to WEA stakeholders regarding events, factors, and actions that may affect trust in the WEA service.

Another challenge arose from the number of factors influencing trust, stressing our ability to confidently cover the space of interactions between factors. These factors could have been assessed in literally billions of combinations. We addressed this issue through the use of fractional factorial design methods and Monte Carlo simulations.

3 Scope of Effort

We identified a myriad of factors related to trust during the review of previous related work on effectiveness of emergency alert notification systems. Examples of the wide-ranging factors included economic, geographic, cultural, and demographic factors. Upon reflection of these factor categories and the mission of this project to develop a quantitative trust model of the WEA system as an aid to guide WEA system deployment and use, we decided to target factors that participants in the WEA system could directly control or significantly influence. Consequently, we leveraged only the previous work related to controllable factors and focused ongoing interviews of emergency alert notification officials and members of the public on potential controllable factors. Examples of factors excluded from the modeling include gender, marital status, employment status, and other personal demographics.

A form of narrative research from interviews and surveys of EMA officials and the public provided the bulk of the information and quantitative data employed within the trust model. We prioritized causal factors of trust that appeared in both the previous literature and the initial expert interviews. Then, we added to the target list additional factors that appeared common to multiple expert interviews. We decided to be more inclusive rather than exclusive with potential causal factors, knowing that subsequent survey results would identify factors that did not appear to be causal in nature to the trust model outcomes. As a result of the above process, we pursued a short list of controllable factors in the trust model that served to drive the subsequent survey questions used to determine the strength of causal relationships within the model.

The last scoping decision involved how to quantitatively treat causal factors that did not have causal factors of their own. These factors would require a probability distribution representing their historical behavior. In the absence of such historical distributions, we decided to implement prior distributions of ignorance, such as the uniform distribution. Essentially, the trust models treat these factors with equal chance of any value on the 0–100% scale. As more historical information about these isolated factors becomes available, the model may be easily updated to incorporate known probability distributions and then used to evaluate different scenarios of factors for resulting values of the trust model outcomes.

4 Assumptions and Constraints

The following assumptions and constraints served to evolve the form of, and inputs to, the probabilistic trust model, thereby influencing the results gained from the modeling effort.

Budget and schedule. During the literature search, we amassed a wealth of information of related work on effectiveness of emergency notification systems. It became apparent that the entire budget and schedule for this project could easily be exhausted in an attempt to thoroughly digest the voluminous materials and, specifically, the bibliographies provided by Dr. Mileti. Consequently, we decided to leverage the materials in a non-exhaustive approach that served to inform the interview questions addressed to the experts and help prioritize the set of factors used to create the probabilistic model. Many factors not pursued in this project could still be the subject of study and evaluation for causal modeling. However, the expert interviews added the necessary confidence to the set of factors identified for continued study in this project.

Access to emergency alert notification officials. Recognizing that emergency alert notification officials had little time to assist with research, as well as the fact that several emergency situations occurred in the United States during the conduct of this project, we interviewed as diverse a set of officials as possible. The combined efforts of the SEI and SRA staff helped to ensure a balance in the expert interviews and provided a rich base of 560 email addresses for the emergency alert notification surveys.

Access to representative members of the public. We encountered a number of barriers in reaching a reasonably sized sample of members of the public to participate in the trust model surveys. Issues of survey representativeness and randomness remained problematic. In Section 11, which covers the analysis of the surveys, we discuss challenges regarding external validity and the ability to generalize from this sample. We finally decided to use over 5,000 email addresses from four different sources to reach a semi-balanced and diverse population. The targeted public email addresses, used with appropriate approvals, were derived from the following four groups:

1. the ASQ Reliability Division membership
2. the ASQ Software Division membership
3. the local Pittsburgh members of INCOSE
4. staff from within the Software Engineering Institute

Limitations on data collection from interviews and surveys. As mentioned earlier, we had to rely on interview and survey data rather than observational data. Specific constraints surfaced during the conduct of the interviews and surveys related to the need to secure feedback on joint conditional probabilities related to scenarios of multifactor behavior. For example, several initial versions of the interview questions and survey questions would have asked respondents to provide feedback on scenarios possessing specific behaviors of 7 to 12 factors. The respondents would have had neither the cognitive ability nor the patience to provide differentiated responses to questions with minor nuances. As a result, we decided to primarily focus on 1:1 factor relationships to build the probabilistic model, with validation scenarios involving 3 to 5 causal factors serving to identify when major interaction effects of factors existed. Aligned with this approach, we adopted an independence assumption among causal factors until sufficient data demonstrated that the assumption was inappropriate. Although specific interaction effects did not appear to surface, some degree of interaction occurred, thereby causing moderated values of trust outcomes in specific scenarios. As a result, some extreme trust outcomes may be understated. Nevertheless, we observed interesting results across the validation scenarios that will drive useful conclusions in the *Maximizing Trust in the Wireless Emergency Alerts (WEA) Service* report.

Need to address diverse scenarios with incomplete information. Early in the project, we learned that the trust model would have to provide results based on limited or incomplete information about different causal factors. This specific criteria significantly influenced the decision to pursue a Bayesian belief network (BBN), knowing that such models may operate with incomplete information.

Need to create a hierarchal model. The relatively large set of causal factors initially identified by the literature review and expert interviews, combined with the need to handle incomplete information of factors, significantly influenced the pursuit a hierarchal model of causal factors. Essentially, instead of having 40 factors all drive a single trust outcome, we decided that the research and modeling would be more practical if conducted in a hierarchal fashion. We observed that experts could help categorize and group causal factors such that they could evaluate more basic “micro” scenarios for strength of relationships. This approach was confirmed during an exercise in which both SEI and SRA experts participated in a cause–effect matrix analysis of potential causal factors. The experts found it practical to evaluate the high-priority cause–effect relationships and think of scenarios in a hierarchal fashion. In the end, this approach helped immensely with the practical aspects of using AgenaRisk as a probabilistic modeling platform.

Compliance with human-subjects research requirements. Realizing early in the project that subjective ratings of causal factors of trust would be necessary, we submitted the required application for Human Subject Research (HSR) and associated HSR materials and received approval from the CMU Internal Review Board (IRB), as shown in Appendix A. The HSR requirements provided much guidance on how to protect the participants of the interviews and surveys and how to collect and secure the resulting data. On the other hand, some of the required introductory language and questions prefixed to each survey may have negatively affected the response rates. Although we did not quantify this detriment, we received oral feedback from some respondents internal and external to the SEI who found the survey too time consuming and bureaucratic to take in a voluntary fashion. Additionally, while the response rates were low (7–12%), the number of responses provided sufficient data to derive an input distribution of prior probabilities for the model. However, the question of bias in the input distribution remains.

5 Approach

During project planning, we developed the project flow depicted in Figure 2. These 14 steps provided the ability for the SEI and SRA staff to contribute in respective areas of strength, coordinate dependencies among activities, and leverage existing work. A short description of each step follows to include the primary value added to the development of the WEA trust models.

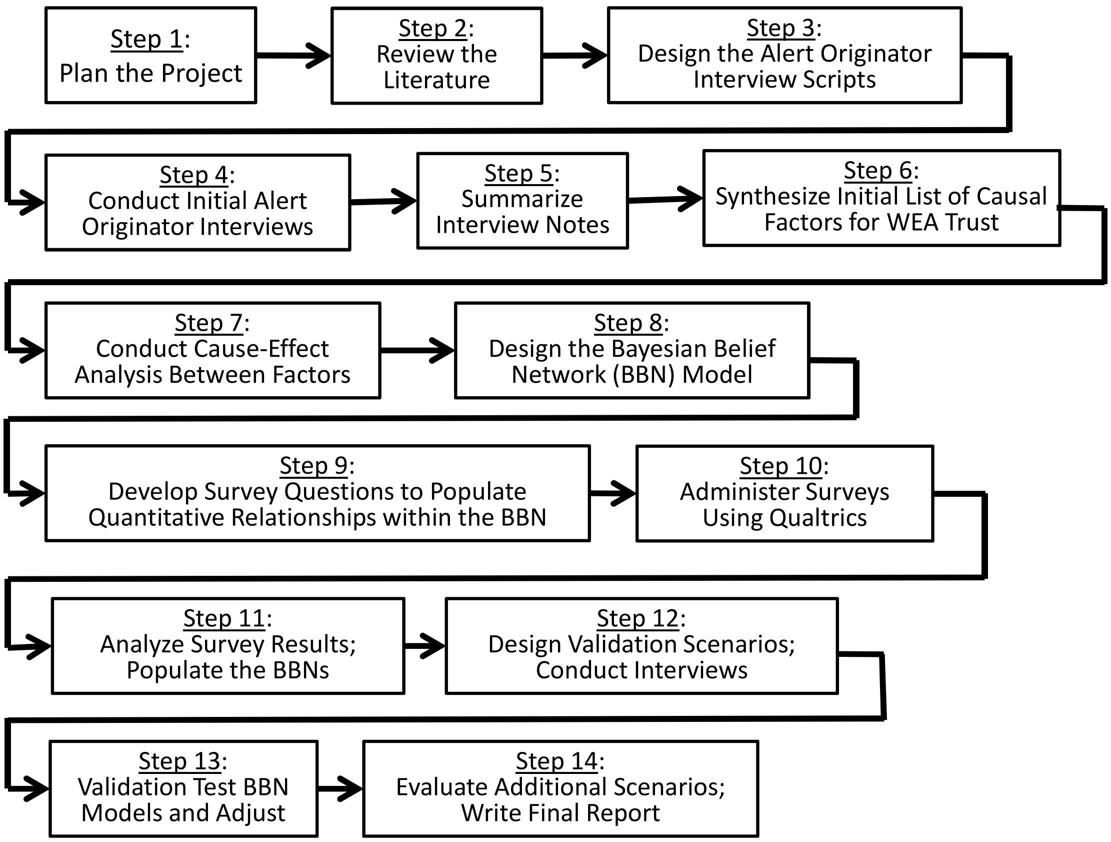


Figure 2: WEA Trust Model Development Flow

Step 1: Plan the Project

We capitalized on a number of previous experiences to help identify the work breakdown structure, effort, and schedule of the development of the WEA trust models. Specifically, SEI team members brought skills in the application of BBNs from previous work both within and external to the SEI. SEI team members also brought skills in the design and issuance of online surveys using the Qualtrics tool. Last, SEI team members brought experience from previous submissions for human-subject research, thereby facilitating approvals from the CMU IRB, as shown in Appendix A. The SRA team members brought experience and information from previous workshops involving a diverse set of AOs. Both SEI and SRA staff contributed valuable contact information for potential survey respondents, thereby eliminating one of the major risks identified for this project.

Step 2: Review the Literature

As we show in Section 6, a healthy literature review provided a wealth of information to guide the development of the trust models. One emphasis during the literature review was to identify previously recorded, controllable factors affecting trust in public alerting systems. Another special emphasis was to identify current research reports' suggestions for next steps and continued research, as this information substantiated and informed the pursuit of a quantitative model. We hope that this modeling effort will contribute to the community's appreciation for such quantitative modeling and inspire additional data collection, cognizant of how such information may be readily applied in an operational model.

Knowledge from the literature review was then augmented by interviews with public alerting subject-matter experts, in particular, Dr. Art Botterell and Dr. Dennis Mileti. Dr. Mileti had authored a number of research reports focused on factors affecting the public response to emergency notifications, including two research reports that provided a wealth of knowledge and insight into factors that appeared appropriate for the trust modeling [Mileti 1990, 2006]. Mileti foretold the need for a quantitative trust modeling approach [Mileti 1990]. Among the topics of discussion with Mileti was our situational need to depend on interview data and survey data from both members of the public and the AO community. While both we and Mileti realized that observational research (measuring actual behavior, possibly under controlled conditions) was a superior way of measuring trust, we also realized that such research was not feasible in this circumstance. We chose to proceed with an interview and survey approach, carefully constructing the interviews and surveys to minimize the risk of reported results diverging from actual behavior.

Step 3: Design the Alert Originator Interview Scripts

The SEI and SRA staff collaborated to create interview scripts consisting of required and optional questions as well as follow-up probing questions for the interviews of AOs. Appendix B provides these interview scripts. The scripts enabled efficient interviews with time-limited interviewees. Most interviews were telephonic, but some interviews occurred in person at the SEI in Pittsburgh. We used these interviews to solicit information on trust factor ideas related to both the public and the AO communities.

Step 4: Conduct Initial Alert Originator Interviews

We conducted a series of interviews of AOs during the period of October 2012 through January 2013. Although we led many interviews with most of the team members present, we led a number of interviews with only one or two team members present. Generally, each interview lasted between 45 and 90 minutes, and we often took turns asking baseline and follow-up questions. Several of the AOs were gracious in allowing follow-up interviews as we sought to further clarify or confirm responses. We were encouraged by how forthright the AOs' responses were with regard to what currently works and does not work within their alert notification systems. Their demonstrated professionalism added confidence in the quality of responses to the interview questions.

Step 5: Summarize Interview Notes

Once all of the interviews were completed, we summarized and condensed the different team members' notes into a single document, shown in Appendix B. This process helped to reduce redundancy and conflict among team members' notes as well as to enrich specific responses based on which team member took the most clear and detailed notes. This process also enabled us to solve uncertainties related to interviewees' use of acronyms and terminology often foreign to most of the team members. The team discussion of the summary notes also served an educational purpose by enlightening team members new to the emergency notification domain.

Step 6: Synthesize Initial List of Causal Factors for WEA Trust

With the interview summary completed, we created an initial list of potential causal factors of trust from both the literature review and the interview results, shown in Appendix C. This list evolved through a number of iterations of team review to the final list of causal factors for each BBN model, also shown in Appendix C. Due to the length of the original list and some overlap or slight nuances in definition, we collapsed a number of factors into single named factors as an aid to the subsequent surveying and modeling. The final list of factors and definitions for the public and AO trust models appear in Appendices D and E, respectively.

For the public trust model, we found Mileti's proposition of a sequential model of Hearing ⇒ Understanding ⇒ Believing ⇒ Acting to be a compelling approach to modeling public trust in the WEA system. Additionally, Mileti's report provided an abundance of factors to consider in the trust modeling [Mileti 2006].

For the AO trust model, we decided on three factors that logically fit the decision process of AOs in determining whether to use the WEA system:

1. Available: Is the WEA service available for use by the AO?
2. Appropriate: Is the WEA service a suitable alert tool for the incident or event?
3. Effective: Does the AO perceive that the WEA service will be an effective alerting tool?

As discussed in more detail in Sections 6 and 7, we first studied factors related to trust identified in previous work, and then verified and extended that understanding through subsequent interviews and surveys with members of both the emergency alert community and the public. The interviews drove the decision process for choosing the high-priority factors to model, and the surveys provided the quantitative basis to link the various factors together and with various trust outcomes.

Step 7: Conduct Cause–Effect Analysis Between Factors

With the reduced set of prioritized causal factors for each trust model, we then conducted a cause–effect scoring between pairs of factors using a cause–effect matrix popularized in scenario planning [Lindgren 2009]. We represent the results of these scorings as hierarchies of factors for the public and AO trust models in Appendices F and G. Due to schedule and resource constraints, the cause–effect scoring remained subjective and based on the consensus of the team. We then used this relationship scoring for the next step of designing the BBN model.

Step 8: Design the Bayesian Belief Network Model

Designing a BBN model with cause–effect arrows may be accomplished in many ways. A researcher with access to a wealth of historical data regarding the factors and their relationships could use a method such as structural equation modeling to help decide which relationship arrows to model [Hoyle 2012]. Alternatively, one could analyze the cause–effect relationship matrix as a design structure matrix [Eppinger 2012] and then use a reduction technique to remove any and all cycles from the matrix. In this project, the simplicity of cause–effect relationships enabled us to informally identify and resolve any cycles in the factor relationships, such that we produced an acyclic graph and directly converted it into a BBN. Appendix H shows the resulting BBN for the public trust model, while Appendix I shows the BBN for the AO trust model. These appendices depict both the condensed forms of the public and AO trust models with primary factors noted and the expanded versions of the public and AO trust models. The expanded models show the additional, artificial joining nodes necessary to accommodate the combinatorial effects often encountered in BBN modeling. Additionally, operational copies of the actual AgenaRisk model files are available to the sponsor as potential assets to be updated and used over time.

Step 9: Develop Survey Questions to Populate Quantitative Relationships within the BBN

Developing the survey questions to enable populating the BBN relationships quantitatively proved to be more challenging than originally envisioned. We originally thought that asking pairs of questions with indications of which factors would be set at each "setting" would be too abstract. Additionally, we remembered from the discussions with Dr. Mileti that what people say and what they do may be entirely different. Consequently, we decided to create survey questions with realistic scenario descriptions for respondents to assess. Although this approach still involved a respondent's answer, it moved the questioning closer to evaluating a respondent's behavioral response. Appendix J includes the surveys for the public trust model while Appendix L includes the surveys for the AO trust model. We developed three surveys for each model after initial time trials confirmed that a single survey would take too much time for a respondent to reasonably finish without dropping out. Consequently, an analysis of the required number of survey questions containing scenarios, along with the number of available email addresses for the public and AO communities, produced a design of three surveys for each BBN model. The analysis appears to have been valid because the subsequent dropout rates for the surveys were minimal.

Step 10: Administer Surveys Using Qualtrics

The SEI administered the surveys using the Qualtrics survey tool, compiling the survey questions into questionnaires within the tool. The questionnaires were then piloted among a select group of people to ensure the proper operation of the tool, presentation of the questions, and collection of the responses.

Our choice of Qualtrics as a survey tool was fortuitous. The SEI already possessed a site license of Qualtrics to conduct surveys, without limits to size or type of survey. Additionally, the ASQ required that its internally adopted survey license of Qualtrics be used to afford maximum protection for members' email addresses. We thus reaped efficiencies with the painless export and import of surveys between the SEI and ASQ Qualtrics licensed installations while maintaining needed control and privacy of email addresses. This arrangement further supported the CMU IRB requirements to safeguard and control raw information and subsequent data from surveys involving human-subject research. Qualtrics also provided the ability to control who took the surveys, thereby satisfying CMU IRB requirements that respondents meet specific criteria before they would be enabled to take the survey.

Step 11: Analyze Survey Results; Populate the BBNs

Once the survey time period closed, we downloaded and analyzed the raw results at the individual respondent level for each survey. Only personally de-identified data was shared among team members for purposes of review and statistical analysis to feed the BBN models. We provide sanitized results of the public trust surveys in Appendix N and sanitized results of the AO surveys in Appendix P and R. We summarized the results in two ways: (1) according to the profile responses against the original 7-point scale and (2) according to a 0–100% probability scale derived from mapping the 7-point scale to the 0–100% probability scale. The primary purpose for converting the ordinal scale of 1–7 to a continuous probability scale of 0–100% was to enable us to populate the BBN trust models with most factors measured on probability scales. However, the AO BBN model and associated surveys maintained both ordinal and nominal factor scales, which served a purpose based on the nature of the factors in the AO BBN model. The AO factor settings are shown in the AgenaRisk tool export in Appendix T.

To populate both BBN models, we compared specific groups of questions to help quantify a given 1:1 factor relationship in the BBN. Appendix K gives the groupings of questions mapped to specific BBN relationships for the public trust model while Appendix M gives the similar mapping for the AO trust model. The statistical comparisons conducted for the 1:1 factor relationships within the public and AO trust models appear in Appendices O and Q, respectively.

To quantify the relationships in the BBN models, we took the following specific approaches. For the public trust BBN model, the probability of acting on a WEA alert message was conceptually a reliability series calculation of the product of the probability of hearing, the probability of understanding, the probability of believing, and finally, the probability of acting. Likewise, within the AO BBN model, the probability of using the WEA system was conceptually a reliability series calculation of the product of the probability that the triggering incident is appropriate for the use of WEA, the probability that the WEA system is available, and the probability that the WEA system would be effective for the given incident. The intended consequence of the reliability series calculation is that each item in the reliability series is required to achieve the overall outcome of Acting or Utilization of the WEA System. Traditional averaging methods would not achieve this because the averaging calculation could mask low probabilities of specific factors. We present the full description of the factor formulas within the public and AO BBN models as automatic AgenaRisk tool content exports in Appendices S and T, respectively.

Step 12: Design Validation Scenarios; Conduct Interviews

The SEI staff members created validation scenarios to use after completing each BBN model as a way to verify external validity and to demonstrate the model validity for scenarios in which interaction of effects might exist between multiple causal factors. To accomplish this, the SEI staff employed fractional factorials from statistically designed experiments to identify a minimum number of scenarios that would test the interactions of a set of factors in context of a given interim or final output factor in the BBN. Consequently, we used a set of fractional factorial designs as the designs for the validation scenarios. As before, each row in a fractional factorial became the basis for a defined scenario in a real-world description that we would evaluate during validation interviews occurring after the BBN model development. Appendix U gives the validation scenarios for the public trust model while Appendix Y gives the validation scenarios for the AO trust model.

These scenarios formed the basis for developing validation surveys for the public and AO trust models, shown in Appendices V and Z, respectively. Although intended to be as efficient as possible, the resulting validation scenarios stretched the patience of the participants in the validation exercise. The scenarios often had only very slight differences requiring strict attention by the validation participants.

To validate the public trust model, we chose a panel of eight representatives of the public at random from the SEI staff. Advance knowledge of the WEA service was not a criterion for selection, and many of the panel members had minimal exposure to WEA. To validate the AO trust model, we interviewed eight emergency management professionals familiar with the WEA service. We conducted the interviews either in person or telephonically.

We provide the results of the validation surveys for the public and AO surveys in Appendices W and AA, respectively. These results proved invaluable to validating the BBN models because they purposely embodied the joint effects of multiple factors, thereby providing the opportunity to see interaction effects on trust outcomes.

Step 13: Validate Test BBN Models and Adjust

Once we evaluated the validation scenarios using the validation surveys, we recorded the results and compared them to the predictions made by the respective BBN model. One way we decided to validate the BBN model adequacy included comparing the BBN model prediction used as an independent variable with the validation scenario interview result used as the dependent variable within a linear regression exercise. Appendix X includes the results of this validation statistical analysis for the public BBN model while Appendix AB includes the results of the validation statistical analysis for the AO BBN model. Most validation results were statistically significant, with adjusted r^2 values in the range of 50–90%.

The major adjustments we made to the models after the validation exercise arose in two areas. First, the original approach of combining different factors into a single interim factor consisted of equal voting through use of a simple averaging scheme. However, validation results demonstrated that such averaging made the BBN prediction insensitive to specific causal factors' behavior when compared to the validation scenario interview result. As a result, we used a weighted average scheme in which each beginning factor received a weight equivalent to the inverse of the factor's value. This adjustment produced results more aligned with the validation scenario interview results. The second adjustment occurred within the AO BBN. Specifically, the AO surveys contained questions concerning the likelihood that the AO would use the system if it were available or the likelihood that the AO would use the system if it would be an effective mechanism for the specific incident. We concluded that such questions were too abstract for AOs to answer reasonably and consistently. As a result, the probability of Utilization of the WEA system within the AO BBN simply became the product of the three probabilities associated with Appropriateness, Effectiveness, and Availability. This adjustment greatly enhanced the sensitivity of the AO BBN to specific factor behaviors as seen in the validation scenario interviews.

In the final analysis, the validation activity produced regression equations that we used to transform the BBN predictions into the expected probabilities of the outcome factors of each BBN. We provide the equations for the public and AO trust BBNs in Appendices X and AB, respectively. We could have easily programmed these regression equations in the BBN nodes for the respective outcome factors, but we chose to show them separately for transparency to the reader. For example, the validation activity of the public trust model resulted in the following formulas, shown in Appendix X, in which the mean probability prediction for an alert recipient taking action in response to an alert is

Expected Acting Probability = –6.04 + 11.6 * *103_Acting*

And the mean probability prediction for an alert recipient believing an alert is

Expected Believe Probability = –6.35 + 12.7 * *100_Believing*

We include similar "calibration" regression equations for the AO BBN model in Appendix AB.

Step 14: Evaluate Additional Scenarios; Write Final Report

After the validation activities, we then evaluated a significant number of additional scenarios to feed conclusions and guidance for WEA system stakeholders and AOs, which we will document in the *Maximizing WEA Trust* report. Scenarios may be evaluated using the executable AgenaRisk BBN files provided to the sponsor. We provide helpful information, including tool configuration settings required to successfully use AgenaRisk, in Appendix AC. At the end of the project, the SEI modeling team members then documented the trust model development journey and artifacts for this technical report, providing sufficient detail to motivate subsequent use and updating of the model as well as compelling evidence that the BBN models may be used to evaluate additional scenarios.

6 Literature Review

6.1 Overview of the Literature

The literature about trust in emergency response focuses on two areas: conceptualizations (principles) and case studies. We address these separately and then cover papers and bibliographies. Most of the literature focuses on the receivers of the warnings (the general public), although some addresses the senders (alert originators). For example, one source asks under what criteria AOs accept an alert for distribution.

Of special note, we benefited greatly from an opportunity to discuss the topic of public emergency notification systems, and the state of the literature on such systems, with Dr. Dennis Mileti. Dr. Mileti's insight, as we will discuss later in this report, influenced team decisions regarding the scope of the trust modeling as well as specific validity concerns with the original research design.

6.1.1 Conceptualizations

In 1990, Mileti and Sorenson reviewed over 200 studies of warning systems and warning response schemes [Mileti 1990]. These reviews are presented in a comprehensive and highly cited paper, but it predated broad use of mobile phones and the internet, so its technological baseline is dated.

The paper defines types of hazards and groups hazards according to the time frame of prediction (short or long), knowledge about impacts (known or unclear), and whether the hazards are easy or difficult to detect [Mileti 1990]. It defines three subsystems of warning systems (detection, management, and response). One chapter discusses the decision to warn the public, content of a warning message, dissemination channels, and the necessity to monitor to what extent the message was received and heeded. Two chapters discuss, first, dilemmas and adverse consequences of warning and, second, technological, organizational, and societal issues such as ethics and a philosophy of warning. Influenced by this paper, we emphasized trust factors related to the timeliness of the alert, the time window to take action, additional detail surrounding the context of the alert, content of the actual alert, and sensitivity to under- and over-alerting the public.

Chapter 5 of the paper describes the process of receiving the warning message and identifies factors that would cause the public to heed or ignore the warning, most of which were of specific interest to this project [Mileti 1990]. Important characteristics of the warnings themselves included the source of the warning (which agency); the channel by which the warning was received; message consistency, credibility, accuracy, and understandability; and the frequency of warnings, all of which we modeled in this project. Characteristics of the population receiving the warning included gender, ethnicity, age, stage of life, family contexts, and individual characteristics such as a tendency to fatalism or risk perception and experience or training regarding the nature of the warning. We deemed these population characteristics, as discussed later, out of scope for the purposes of this trust modeling project. The paper also debunks a series of popular misconceptions about the behavior of the public, belief in which can make warnings less useful and even self-defeating.

Mileti and Sutton created a PowerPoint overview that mitigates the dated aspect of Mileti and Sorenson's earlier work by addressing social media and today's constant flood of media coverage

[Mileti 2009]. We addressed both corroboration in social media and the frequency and repetition of alerts in this project. This presentation also offers a separate, large bibliography, describes official warning systems, notes myths, and makes recommendations. Myths include panic, starving the public of information in the name of simplicity, responses to false alarms, control of warning information, and the validity of warnings that the public finds via social media. Both the history of false alarms and the ability to corroborate alerts with social media did persist as factors in our trust models. Mileti and Sutton conclude that message content, repetition, cues, and milling are very important. Their list of factors that go into an "evidence-based" warning informed a number of factors in our models.

Jackson, Faith, and Willis took an engineering approach to evaluating the reliability of emergency response systems [Jackson 2010]. They apply the failure-mode effects and criticality-analysis technique from systems engineering to assess what could go wrong with an emergency response system, how likely and how consequential the failure would be, and methods of computing a reliability number. Such analyses can vary depending on assumptions about public response and thus provide input into trade studies about different warning strategies. This work influenced our decision to adopt the Available, Appropriate, and Effective trust factors within the AO trust model. It also convinced us to adopt a probability-based approach to modeling trust, including a reliability series calculation that multiplies probabilities of the sequential parts, effectively treating each aspect as essential to the overall function of trust.

Aloudat and Michael review how "location-based services" have been used to date in warning systems [Aloudat 2011]. Location-based services include "any service that provides information pertinent to the current location of an active mobile handset." For example, Enhanced 911 (E-911) calls and notifications can be sent to all cell phones within a geographical location affected by a disaster warning. The authors compare Short Message Service (SMS) text message technology with Cell Broadcast Service (CBS). SMS messages are sent to one phone at a time, which can be very slow. Furthermore, SMS messages are not delivered to phones *located* within a designated area; they are delivered to phones *registered* within a designated area. CBS broadcasts to all handsets within one cell tower area and can be very fast, but the handset must be capable of receiving and displaying such broadcasts.

Aloudat and Michael give a brief history of warning networks in the United States, including WEA under its former name, the Commercial Mobile Alert System (CMAS) [Aloudat 2011]. Information is provided about other countries ranging from Finland to Malaysia regarding the technology used, whether carriers participate voluntarily, and whether they are compensated by the government. The paper concludes with basic and optional requirements for a location-based emergency system.

Sanquist, Mahy, and Morris discuss the public acceptability of 11 types of implemented security-enhancing systems and activities [Sanquist 2008]. They measured attitudes along with 14 system-rating attributes; attitudes depended mostly on perceived effectiveness and perceived intrusiveness. The paper helped identify what factors cause distrust among the public and thus helped frame the trust discussion. They discussed evaluation of trust as a "next step." From this work, we decided to include a number of trust factors associated with public awareness, perception, relevance, and history of relevance in the trust models.

In an International Atomic Energy Association lecture titled “Instructing, Warning, and Informing the Public,” Lafortune and Borth describe how to communicate with the public regarding radiation emergencies [Lafortune 2011]. They stress that “Honest, accurate, and timely information builds trust.” AOs (or perhaps more accurately, designers of warning protocols) should understand how the media works and use it to maximize the effectiveness of their alerting practices. Both trust models in this project also attempted to cover the dimensions of honesty, accuracy, and timely information. Additionally, we modeled trust factors related to corroboration in social media and the degree to which multiple sources were used in the alert.

The Working Group on Governance Dilemmas in bioterrorism described five strategic goals of leadership in the case of deliberate or accidental epidemics: limiting death and suffering, defending civil liberties, preserving economic stability, discouraging scapegoating, and improving resilience [Schoch-Spana 2007]. Conflicts among these lead to leadership dilemmas. This report provides recommendations for addressing these goals while maintaining or growing “social trust” based on a factual understanding of myths about public behavior during emergencies. For example, public panic occurs in movies more often than in reality; fear of panic is not a reason to withhold information. The trust models in this project consequently investigated factors related to a recipient’s ability to seek corroboration via information from additional channels and via confirmation from other alerting organizations, due to overlap in geographic responsibility.

McGee and Gow examined university emergency alert systems and reported on what factors lead to better adoption of the Mileti warning response process activities (hear, believe, act, personalize, etc.) [McGee 2012]. Messages were sent by SMS. Most students heard and understood the messages, but they were unsure about vaguely described threats and unsure where and how to evacuate. As a direct consequence, we included trust factors related to clarity of the alert message, message content and context, including relevance; reason to take action; and the nature of the recommended action to take.

Wood, Bean, Liu, Madden, Mileti, and Sutton compared formats of messages, including CMAS messages, from 90 characters up to 1,380 and more, to see how people reacted to them [Wood 2012]. They included a modified form of the Mileti factors under the heading “‘Sensemaking’: Understanding, Believing, Personalizing, Deciding, and Searching and Confirming.” We modeled a trust factor related to the text length of an alert message in the AO trust model, thereby seeking to capture that community’s sensitivity to how the length of the text message impacts perceived effectiveness of the alert.

Brothers and Pavlov modeled public risk perception, events, event media coverage, and response, including economic activity, using system dynamics [Brothers 2009].

Kapucu focused on factors that make a university more resilient to disaster. The factors on the figure on page 24 contributed to this work’s original set of factors [Kapucu 2010].

Burns and Slovic modeled a community’s response to a terrorist attack with systems dynamics modeling [Burns 2007]. The authors in particular discuss how fear diffuses. Although they do not discuss warnings specifically, they provide a good scenario with context for warnings.

Glantz reported on a workshop held in Shanghai regarding early warning systems, with most of the attendees coming from weather and “hydrological” backgrounds [Glantz 2004]. One group of participants focused on issues related to "receiving, believing, and acting on the warning" and thus is very relevant to this work. We used the chart on page 56 of this report to help in understand Receiving, Believing, and Acting on warnings. Glantz's Appendix 1 is a case study of hurricane warnings, prior to their hitting land in Cuba.

6.1.2 Case Studies

Most case studies of emergency warning systems accommodate a wide variety of potential emergencies, including weather events such as tornadoes and hurricanes, geophysical events such as earthquakes, technological events such as the release of radiation, terrorist acts, and even alerts about abducted children. The case studies tend to focus attention on how the news of the event is transmitted to members of the public who need to hear it. Some case studies are limited to warnings appropriate to a specific agency, such as just weather [e.g., Jacks 2010].

Pelusco and Michael discuss trust in the sense of ethics rather than in the sense of how to implement trust in a warning system [Pelusco 2007]. They used scenarios to provoke positive and negative responses from the participants regarding the ethics of using systems that transmit their own locations to other service providers. Both security and privacy risks can result; the authors suggest removing any of three driving causes because each reduces the risk significantly. The trust models in this project did address security as well as the opt-out rate by the public, which could be motivated by a wide range of reasons.

Fuller, Abramson, and Sury investigated the trust of communities (different ethnic and minority neighborhoods of New York City) in a hypothesized pandemic flu warning [Fuller 2007]. The communities had varying levels of trust in the government, particularly the local government, and had different concerns. The report cites a need to create clarity (a "brand") regarding emergency messages. Other recommendations were to use "311" as a source of emergency information and to increase health department outreach. We modeled the source of an alert (local vs. federal) and the degree of public awareness of the WEA system as trust factors. Although we originally considered factors such as the public's general trust in government, we excluded these types of factors during a simplifying decision to prioritize focus on factors more directly controllable by AOs and WEA system operators.

Jacks, Davidson, and Wai extend the ideas of weather-forecasting systems to manmade disasters, including a shift from crisis management to risk identification and risk management [Jacks 2010]. They describe "nowcasting," or immediate weather forecasting. Chapter 4 provides a number of hazard warning system examples. In general, this article takes a government policy point of view and does not describe the trust that the general public has in any warnings.

Udu-gama discusses the feasibility of implementing a public warning system using cell broadcast for the nation of the Maldives [Udu-gama 2009]. Her table of SMS vs. CBS features cites Aloudat and Yan [Aloudat 2007]. Udu-gama discusses systems and mobile providers in the Maldives today and compares their features to the needs for an emergency system. The author details how general considerations apply to the Maldives, which consists of multiple archipelagos.

Faith, Jackson, and Willis studied failure types following 70 representative incidents [Faith 2011]. They developed a fault tree that showed different causes for a failure at an emergency operations center (EOC), then coded the 70 incidents according to which actual causes occurred.

Redlener, Abramson, Stehling, Grant, and Johnson survey the readiness of U.S. communities for responses to terror, security, and other disasters [Redlener 2007]. Questions included confidence in government, ability and willingness to evacuate, personal preparedness, and perceptions of community preparedness. Many Americans believe that the threat of disaster is high; however, this does not often prompt them to make preparations for disasters. This paper touched on the "believe" activity: Americans believe weather-related emergencies are more likely than other types and trust the CDC more than FEMA, and FEMA more than the president (G.W. Bush).

Perusco and Michael evaluate location-based services regarding control, trust, privacy, and security using five connected fictional scenarios to identify security and privacy risks [Perusco 2007]. The article focuses on the ethics of the situation. Both kinds of risk could be reduced by ensuring that at least one of the contributing factors is small.

RAND assessed the effectiveness of state and local health departments in communicating about a (rare) public health emergency, the H1N1 (Swine) flu [RAND 2009]. In general, the states responded quickly and well. However, only 34% of local public health departments provided information within 24 hours, and over half of those responses consisted of links to national sites rather than containing any local information. Ringel, Trentacost, and Lurie provided background and more discussion about why the local agencies fell short [Ringel 2009].

Kapucu made recommendations to improve the disaster-resilience of the University of Central Florida [Kapucu 2010]. The figure on page 24 provides factors for the content of alert threats.

Stanley and Sutton describe types of alert systems in use in different places, how well they work, and what issues there might be, including trust issues [Stanley 2011]. They describe uses of social media in warnings. They also discuss usability for at-risk subpopulations. They do not present any explicit modeling, but their activities are similar to Mileti's "Hear/Understand/Believe/Confirm/Personalize."

6.1.3 Review Papers and Bibliographies

We used review papers and bibliographies to help us find the sources of factors to include in our analysis.

In their Appendices A and B, Mileti and Sorenson list references by stages of the warning response process: factors that influence Hearing, then Understanding, Believing, Personalizing, Response, and Confirming [Mileti 1990]. Within each category, both Sender and Receiver factors are included. From the Believing factor onward, these are followed by process factors as well. Mileti and Sorenson list factors that affect these stages and cite multiple papers that address each, including page numbers. They cite a total of 138 papers.

Mileti and colleagues also distributed a 347-page bibliography ("Annotated Bibliography for Public Risk Communication on Warnings for Public Protective Actions Response and Public Education, Revision 4") in 2006 [Mileti 2006]. This includes citations, abstracts, and causal findings, arranged alphabetically, one reference per page.

Bean, Dietz, and Palidwor supplemented the 2006 Mileti work, citing 44 works published after 2004 [Bean 2012]. The topic was efficacy of warning messages. They follow each citation with its abstract, a discussion of method and messages, and findings and implications.

Earle reviews studies of trust in risk management, noting the dimensions of trust (intent and abilities; he considers the latter not trust but confidence), its functions (to reduce complexity via social risk-taking), and various ways of modeling trust [Earle 2010]. Earle codes a total of 132 references to trust or confidence, hazard contexts, referents, antecedents, and consequences.

Sorensen addresses the changes from 1980 to 2000 in prediction and forecasting of hazards, integration of warning systems, dissemination of warnings, and understanding responses to warnings [Sorensen 2000]. Some types of hazard have seen major improvements in prediction or forecast (e.g., hurricanes and hazardous material) and in integration of warning systems (e.g., earthquakes, nuclear power), but in many cases improvements have been slight. Much has improved in deciding when to tell people to evacuate but not in explaining responses to those warnings. Thirty-two factors influence response, but understanding of mechanism is incomplete for many of them, and emergency planners can affect only a few of the factors through design of the warning system. Sorensen's paper cites 43 references. Based on this work, we decided to include several trust factors addressing alert content, context, why a person should act, and the nature of the action to take.

6.2 Literature Search Conclusions

The literature search, including conversations with Dr. Mileti, provided a solid basis for scoping the trust modeling project and to more efficiently design the initial sets of interviews with emergency alert notification staff. Combining the literature review and interview results provided a more reliable foundation for producing trust models for both the public and the AO communities. Additionally, much of the other research in the literature confirmed the need for investigation into the quantitative modeling of trust in emergency notification systems. We will amplify this direct connection in Section 14, which addresses future work in this area.

7 Interview Results

The initial AO interviews were intended to provide a current baseline of knowledge concerning emergency alert notification systems. We recognized that although research literature from the past five years was available, the landscape and experiences with notification systems appeared to be fluid, as is common with emerging technologies. The interview questions, which we reproduce in Appendix B, were thus motivated by a sense of exploring what appears to be working versus not working. Additionally, the interview questions sought to anticipate future needs and concerns from the AOs' perspectives, thereby modeling factors that may become significant with respect to trust in the WEA system.

To accomplish this, we selected AOs not only for their experience but for their recent experience with emergency notifications. The AOs interviewed for this project comprised federal, local, civil, and academic organizations (see the Acknowledgments for a partial list). We provide a condensed summary of the interview notes in Appendix B.

From the common themes within the interview notes, an initial list of potential causal trust factors emerged, which we include in Appendix C. We subsequently analyzed these factors and reduced them to a set that drove the probabilistic modeling of trust along with surveys to help quantify the strength of relationships within the probabilistic models.

8 Basis for Modeling

Probabilistic modeling, specifically Bayesian belief network (BBN) modeling, first appeared opportunistic due to the need to model subjective expert opinion. A current reference by Fenton and Neil proved useful and timely for this work as it is a companion to the AgenaRisk modeling software employed for the BBNs [Fenton 2013]. Although Fenton and Neil provide excellent contextual information for BBNs instantiated with the AgenaRisk tool, Martz and Waller adeptly summarize the key reasons and benefits of using BBNs as follows [Martz 1991]:

- **BBNs perform objective and subjective data modeling.** BBNs are probabilistic models that characterize factors with probability distributions. The probability distributions are often subjective in nature, reflecting degree of belief from a domain expert. These models incorporate the concept of combining prior knowledge of a factor with current observational data or expert judgment to produce an updated assessment of the factor. This modeling represents a superset of traditional statistical modeling from the standpoint that in the absence of prior knowledge (e.g., using a non-informative uniform probability distribution), the calculations yield results similar to traditional statistical analysis. For the WEA trust modeling, the ability to model subjective factors combined with the freedom to include any objective information provided the robust modeling platform to meet the customer's needs.
- **BBNs operate with incomplete information.** Traditional statistical modeling, such as regression modeling, usually requires knowledge of all the modeled factors before formulating a prediction. BBNs, on the other hand, are adept at formulating predictions with one or more of the factors left unknown or unobserved. This specific aspect provides needed flexibility in evaluating many possible scenarios from a trust perspective. Additionally, real-life scenarios often have incomplete or missing data, whether rooted in data collection shortcomings or in data misreporting.
- **BBNs predict forward.** Similar to traditional statistical modeling, BBNs can predict forward, disregarding whether time or logical dimensions apply.
- **BBNS diagnose backward.** Contrary to traditional statistical modeling, BBNs can simultaneously diagnose backward, for example, to explain the likely conditions that preceded the current situation or given outcome. To be more specific, as new evidence or observations are made known to a BBN, the BBN will propagate updates in all directions to the unknown or unobserved factors.
- **BBNS evaluate unprecedented scenarios.** Because of a combination of the above strengths, BBNs are capable of evaluating unprecedented scenarios. Specifically, Martz and Waller advocate Bayesian analysis for reliability modeling so that researchers can still model and evaluate unprecedented failure modes, which have no failure data [Martz 1991].
- **BBNs support learning mechanisms.** BBNs inherently can accommodate a learning mechanism not unlike that of neural networks. A stream of new evidence and observation may be fed into a BBN, with learning occurring via the use of updated prior and likelihood probability functions. Learning Bayesian mechanisms may be most popularly seen in email spam filters and in Kalman filters used for electronic systems.

Bayesian analysis has experienced a roller-coaster history of embracement and rejection, as recorded in a history of Bayesian analysis by McGrayne [McGrayne 2011]. Critics often complain that the incorporation of subjective data remains intolerable and subjects the analysis to gaming. On the other hand, modern statisticians, such as Kruschke, not only defend Bayesian analysis but now proclaim Bayesian analysis superior to null hypothesis testing (NHT) and argue for the immediate cessation of NHT as a statistical tool [Kruschke 2010]. Disregarding how the reader may view Bayesian analysis, the SEI staff remain convinced that BBNs are but one of many tools in the quantitative toolkit (statistical, probabilistic, simulation) that should be used in a situational manner. The next section will provide more detail on the use of BBNs for the WEA trust modeling, thereby increasing confidence in such use of BBNs.

9 Development of the Trust Models

The development of the two BBN trust models occurred in Steps 7 and 8 of the 14 steps described in Section 5 of this report. Once we identified the short list of causal trust factors (see Appendices D and E), the next step (Step 7) was to decide what the relationships were among the causal factors and between the causal factors and the trust outcomes. For the public trust BBN, the primary trust outcomes included the probability of Hearing the alert, the probability of Understanding the alert, the probability of Believing the alert, and the probability of Acting on the alert. For the AO trust BBN, the primary trust outcomes were the Availability of the WEA system, the Appropriateness of using the WEA system, and the perceived Effectiveness of using the WEA system. In the absence of a wealth of historical data pertaining to these factor relationships, which could have been analyzed with structural equation modeling techniques [see Hoyle 2012], we conducted a cause–effect matrix analysis, leveraging a scenario planning technique from Lindgren and Bandhold [Lindgren 2009]. Essentially, we evaluated all of the possible one-to-one relationships between factors and assigned a strength score for each directional relationship of cause and effect.

Upon completing that exercise, we proceeded to break any cycles in the set of factors, knowing that we would need an acyclic network for developing the BBN. The resulting hierarchal list of factor relationships appears in Appendices F and G. We did not need to break iterative cycles and feedback loops among the factor relationships within the AO BBN, as the factors were so completely distinct in their relationships. However, the public BBN did possess a number of factors that simultaneously influenced the different steps of hearing, understanding, believing, and acting on an alert message. We evaluated the impacts of arbitrarily breaking cycles in the public BBN and remained confident that the arbitrary breaking of the cycles had minimal impact on the outcome nodes. This is because the nature of weak versus strong factor relationships and the nature of the hierarchal design of the BBN cause the broken path to be relatively distant from the outcome factors in the BBN.

Before discussing the internal mechanisms of the public and AO BBNs, a quick discussion of BBN models is warranted. As described by Fenton and Neil, BBNs consist of a set of nodes representing factors in the model [Fenton 2013]. Some nodes may represent factors that are strictly either causal or effect in nature while other nodes may represent factors that are both causal and effect in nature. For example, as may be seen in the AO BBN model in Appendix I, the node labeled Training represents a factor that is causal on the factor Available but is also an effect of the combined factors of Skills & Competencies, Understanding, and Practice. In this example, the factors Skills & Competencies, Understanding, and Practice are strictly causal factors. The only strictly effect factor in this BBN model is the final outcome factor represented by the node labeled WEA Utilization. As the reader most likely has surmised by now, the arrows connecting the nodes in the BBN represent directional cause–effect relationships. In some cases, the cause–effect relationship may be weak or viewed as an indirect, influencing relationship or leading indicator relationship. However, as Fenton and Neil point out, BBNs can be more easily portrayed and communicated if the arrows do represent cause–effect relationships [Fenton 2013].

Factors within a BBN may possess any of the possible measurement scale types to include nominal, ordinal, interval, or ratio. Nominal factors would be viewed as having discrete states or levels, such as the factor Public Awareness in the AO BBN (see Appendix I). The Public Awareness factor has two states or levels consisting of (1) the public was previously informed of the WEA system and (2) the public was not previously informed of the WEA system. Other factors in the BBNs are ordinal in nature such as the AO BBN factor called Alert Frequency. Alert Frequency has an ordered set of states consisting of (1) several alerts in the past week, (2) several alerts in the past month, and (3) several alerts in the past year. Finally, other factors reflect a continuous scale (interval and ratio), such as the factor Effective in the AO BBN model. The factor Effective possesses a continuous measurement scale of 0–100, representing a probability score. All of the continuous factors in both BBNs represent probability scales from 0% to 100%.

Appendices S and T depict the measurement scales, states, and foundational formulas used to derive the factors within the public and AO BBNs, respectively. Another nuance related to the instantiation of factors within the AgenaRisk BBN models concerns the continuous factors. AgenaRisk enables continuous factors to be declared simulation variables while other continuous variables are not simulation variables. The simulation variable distinction enables AgenaRisk to conduct more efficient processing of Bayesian propagation algorithms; therefore, we used it when possible. Fenton and Neil provide additional information on the nature and use of simulation variables within AgenaRisk [Fenton 2013].

We show the public trust BBN model in both condensed and expanded format in Appendix H. The condensed format depicts only the cause and effect factors related to the public trust of the WEA system. The expanded format depicts the additional synthetic nodes required in the development of BBNs to reduce the combinatorial explosion of factor relationships. See Fenton and Neil for guidance on the approach of using synthetic nodes [Fenton 2013]. In the public trust BBN model, the four primary outcomes of trust involve the probabilities of Hearing, Understanding, Believing, and Acting on the alert. Several other factors are modeled as hybrid cause and effect nodes, to including (1) Alerts Viewed as Spam, (2) Opt Out Rate, (3) Confirmation by Social Media, and (4) Relevance of the Alert. These four factors are influenced by other factors and then, in turn, influence the primary outcome factors listed above.

We show the AO trust BBN model in both condensed and expanded format in Appendix I. In similar fashion, the condensed format depicts only the cause and effect factors related to the AO trust in the WEA system while the expanded format depicts the additional synthetic nodes to handle the combinatorial explosion of relationships. The primary outcome of the AO BBN model is the probability of WEA Utilization by the AOs. The additional outcomes of trust include the Appropriateness, Effectiveness, and Availability of the WEA system. Each of these additional outcomes is influenced by separate factor sets comprised of 7 to 12 individual factors. As opposed to the public trust model, which incorporated predominantly continuous factors measured on a probability scale of 0–100%, the AO factors are predominantly measured on nominal or ordinal scales. We give the specific states or values of these factors in Appendices S and T, along with the formulas used within the BBN. For example, the node labeled Geographic Breadth contains four states describing the different geographic situations of WEA system coverage for a given alert as follows:

70% outside zone

50% outside zone

30% outside zone

10% outside zone

There are several ways to execute the BBN models for purposes of this research. The first use case comes from the public BBN model, as shown in Figure 3 to Figure 8. It consists of the ability to evaluate a given scenario that comprises observed or hypothesized values for a number of factors followed by assessing the impact on an outcome factor, such as the probability that an individual will take action based on a WEA alert.

To begin with, Figure 3 depicts the probability expectation for Acting on a WEA alert with no specific knowledge of the state of any other factors. In this example, Figure 3 shows that the range of the 25th percentile to the 75th percentile of the probability of Acting is 5–12%. The reader should also note that the BBN tool does not understand that negative values of probability are not allowed, as shown in Figure 3, which depicts a mean and standard deviation that would obviously include negative probability values.

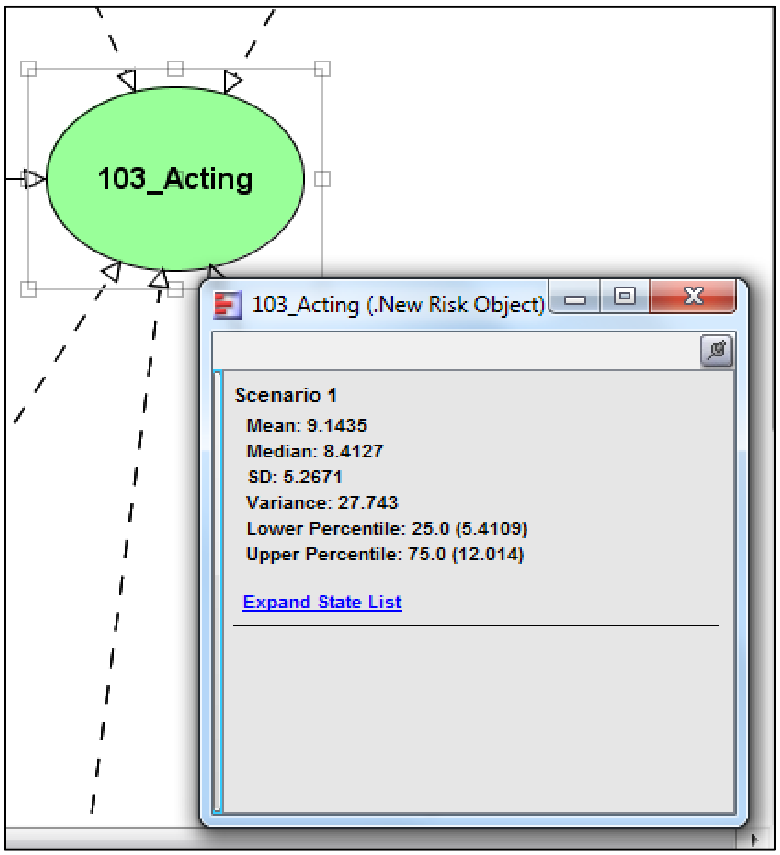


Figure 3: Probability of Acting on a WEA Alert with No Knowledge of Other Factors

Figure 4 and Figure 5 show how one can now use AgenaRisk to enter an "observation" or presumption of a setting for the Relevance factor. In this example, Relevance is a continuous factor representing the probability that the WEA alert is relevant to the individual. A 0 in this example implies there is no relevance of the WEA alert to a recipient. Alternatively, a 100 would have implied a certainty of relevance of the WEA alert to the recipient.

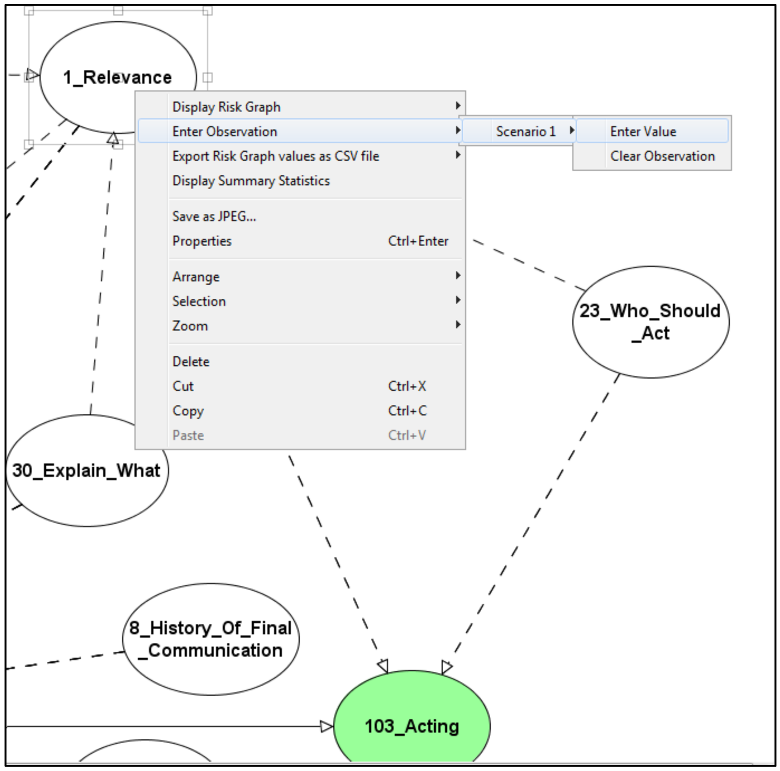


Figure 4: Using AgenaRisk to Enter a Presumption for the Relevance Factor

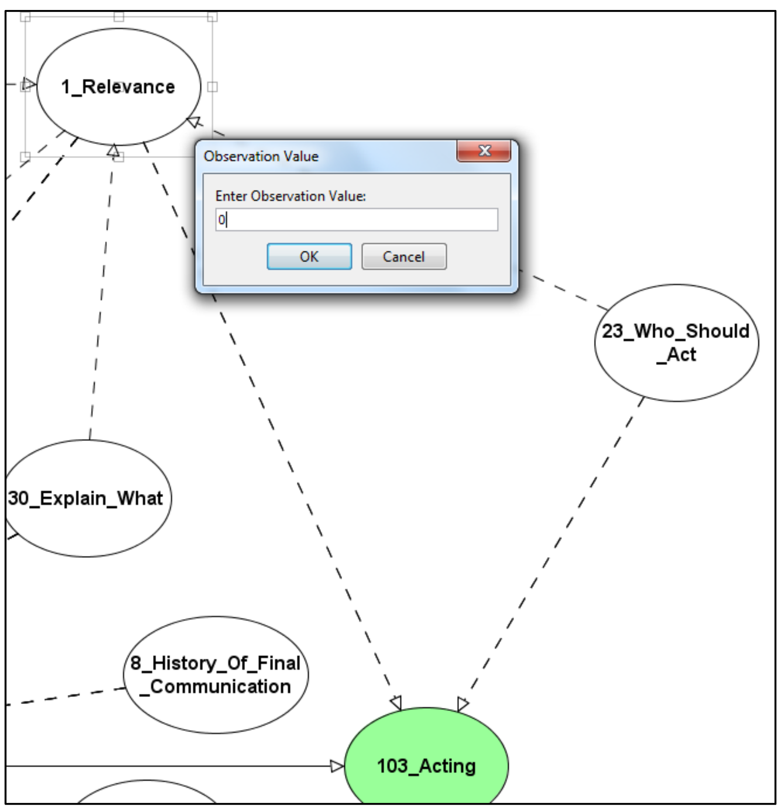


Figure 5: Entering 0 Implies There Is No Relevance of the WEA Alert to a Recipient

As may be seen in Figure 6, we set three other factors to a probability value of 0. This example consequently models the scenario in which we set all four factors (Relevance, Action to Take, Lead Time Provided, and Time Window to Act) at their most negative settings related to trust in the WEA system. Upon completion of the AgenaRisk simulation, the resulting probability of Acting on this WEA alert changes slightly to a 25th percentile to 75th percentile range of 5–11%, as shown in Figure 7. Although this appears as a minor change in the probability assessment, the validation activity for this model produced a calibration equation that we will discuss in Section 13. We must apply the calibration equation to the BBN model prediction of probability to arrive at the expected probability; therefore, the calibration equation may depict a larger change in probability than the raw values from the AgenaRisk simulation. Indeed, the validation activity of the BBN models did uncover a number of factors that have very little impact on interim and final trust outcome factors. However, we retained all factors in both of the BBN models to enable the reader to observe that the data from the surveys did differentiate between significant and nonsignificant factors as drivers of trust.

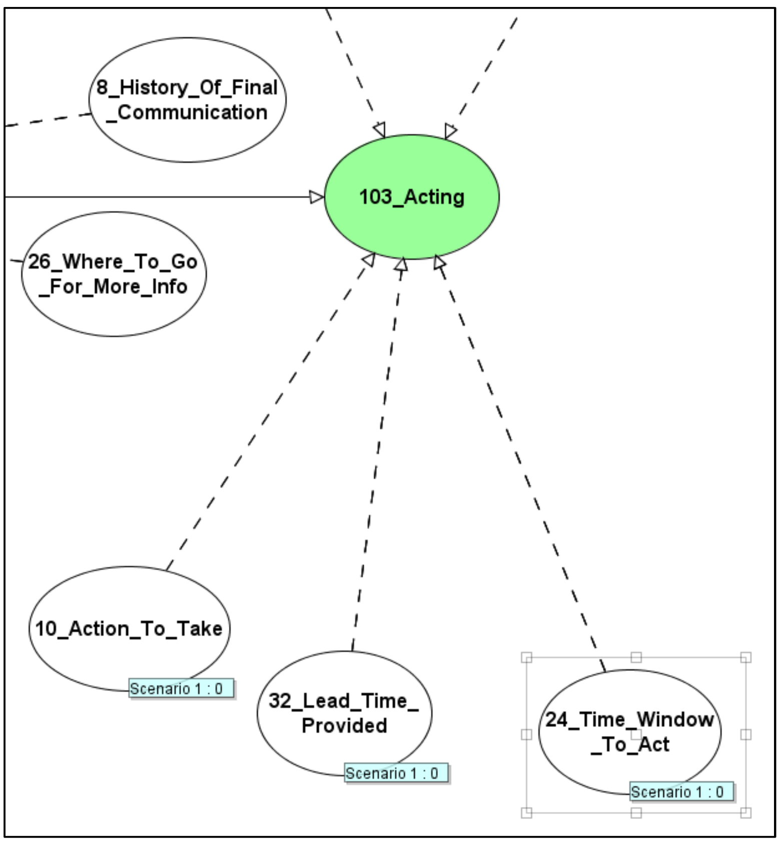


Figure 6: Setting All Four Factors Related to Trust at Their Most Negative Settings

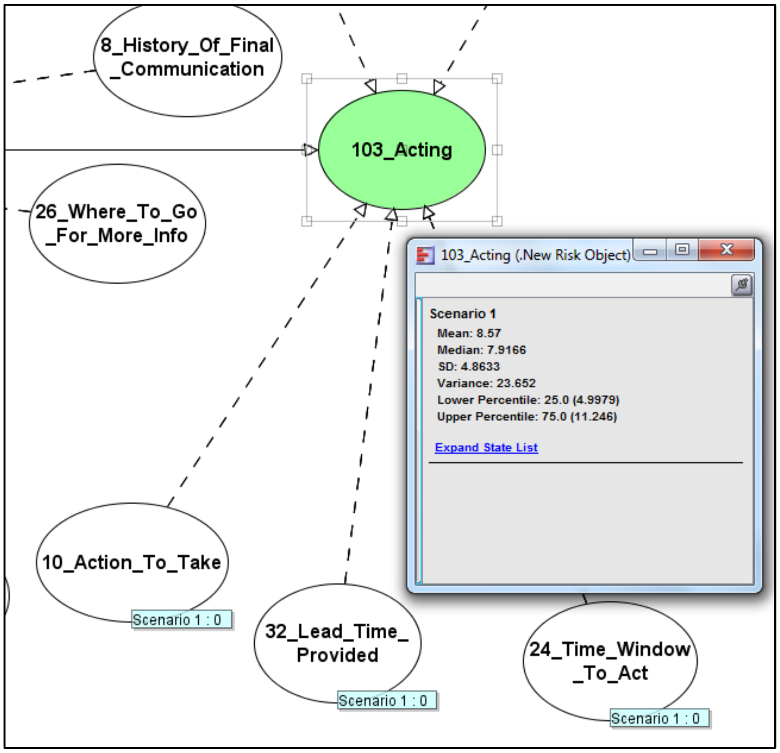


Figure 7: Probability of Acting on the WEA Alert Changes to a 25th–75th Percentile Range of 5–11%

A second capability of the AgenaRisk BBN models consists of constructing a sensitivity chart showing the factors in priority order that influence a given interim or final outcome factor. This is useful from the standpoint that within any given scenario, AgenaRisk can report which factors are most influential on an outcome factor. This type of information could serve to guide follow-on probing questions of domain experts when discussing and analyzing different potential scenarios of cascading change drivers. We could also use this information to help assess the highest priority risk factors and improvement factors within a given scenario. As shown in the sensitivity chart in Figure 8, the outcome of Acting on a WEA alert is most influenced, as expected, by the probability that the alert is Believed, followed by the probability that the alert is Understood, followed by the probability the alert is Heard, and last, the probability that the alert contains specific information on Who Should Take Action.

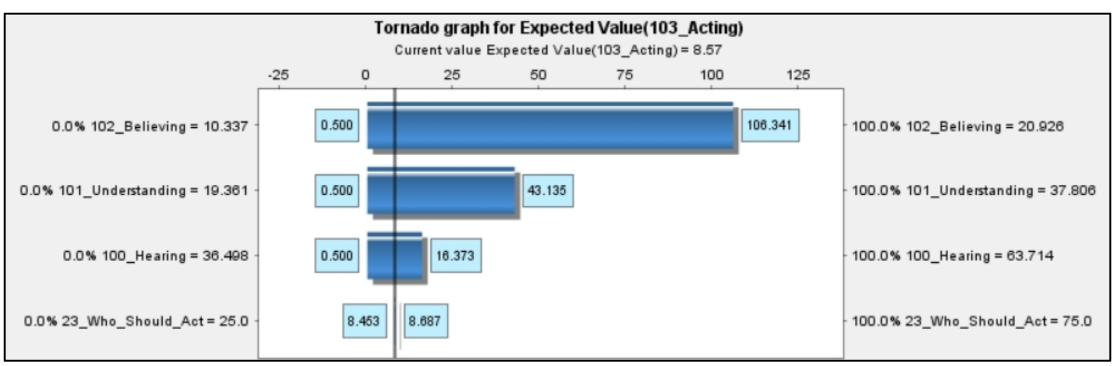


Figure 8: Factors Most Influential on the Outcome of Acting

A third capability of the AgenaRisk BBN model may be considered a variant of the second capability previously discussed. The third capability involves the ability to determine the settings of "upstream" factors that most likely explain a given setting of an interim or a final trust outcome. This may be helpful in answering questions about which likely scenarios of factors lead to a given value or setting of a trust outcome factor. This capability could prove most useful when dealing with a situation requiring real-time and quick feedback to diagnose what led to the current situation, possibly enabling immediate mitigating actions.

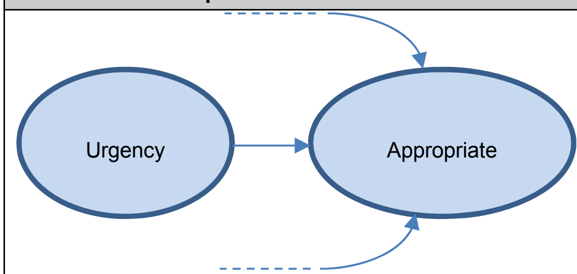
In summary, we use the BBN models to evaluate "what if" scenarios, understand the most significant factors of specific trust outcomes, and diagnose what likely events led to a specific trust outcome.

10 Development of the Trust Surveys

With the trust factors established in Step 7: Conduct Cause–Effect Analysis Between Factors, and the cause–effect relationships established in Step 8: Design the Bayesian Belief Network Model, we constructed a survey questionnaire that we could use to measure these relationships. For each of the arrows in the BBN network, we crafted a question or series of questions that enabled assessment of the strength of the indicated relationship.

For example, in the AO trust model, Urgency is a factor contributing to the Appropriateness of WEA as an alerting solution. In other words, an event must be sufficiently *urgent* for an AO to consider WEA as an *appropriate* alerting solution. We created a series of questions regarding the appropriateness of WEA for varying levels of urgency, as shown in Table 1.

Table 1: Survey Question Development

Factor Relationship	#	Questions
	1	Do you think WEA would be an appropriate tool to issue a public alert for an event that requires a public response …
	a	… within 10 minutes
	b	… within 30 minutes
	c	… within 60 minutes
	d	… within 2 hours

Question responses were on a seven-choice Likert scale:

- Definitely Not
- Very Probably Not
- Probably Not
- Maybe
- Probably
- Very Probably
- Definitely

Comparing the response distributions across this set of questions provided a measure of the strength of this relationship.

Question sets of this nature were created for each relationship in each of the BBNs. This resulted in a collection of 58 questions for the public trust model questionnaire and 36 questions for the AO trust model questionnaire. Piloting of these questionnaires revealed that the time required to complete the questionnaires was excessive, at more than 15 minutes per survey. Such a lengthy questionnaire would have negatively impacted the response rate. Hence, we divided each questionnaire into three parts, with each part sent to one third of the total sample. Piloting of these reduced questionnaires yielded an average response time of approximately 5 minutes, which we thought was acceptable.

Appendix J reproduces the resulting surveys for the public trust model, while Appendix L reproduces the surveys for the AO trust model. We also mapped the survey questions to the specific factor–factor relationships within each BBN model. The mapping between the public trust surveys and model appears in Appendix K, while the mapping between the AO trust surveys and model appears in Appendix M.

We used the Qualtrics survey tool to issue the surveys for this project. The surveys of the SEI staff and the AOs were conducted through the SEI's licensed installation of Qualtrics while the surveys of the ASQ Software and Reliability divisions were conducted using the respective ASQ division's licensed installation of Qualtrics. In this manner, the ASQ membership email addresses were not released outside of the ASQ domain, in keeping with their existing policy on the control and usage of their membership email lists. The SRA team members provided a list of 560 email addresses of emergency alert notification staff from federal, state, and local organizations across the United States. SRA developed this list from previous workshops and correspondence with the emergency alert notification community as recently as the fall of 2011.

Table 2 characterizes the target audience for the public trust model surveys; it consisted of individuals from four sources in which email addresses were accessible within the required schedule. The figure also shows the approximate number of invited respondents and the actual number of respondents. Due to incomplete responses, the corollary analysis of the surveys may depict slightly different sample sizes. The very low response rates within the ASQ Software Division membership occurred due to a last-minute decision by the ASQ Software Division to forego use of the Qualtrics tool email utility and, instead, deliver the survey invitation and survey link embedded within a monthly electronic newsletter. We expected this to cause a precipitous drop in response rate but, nevertheless, the ASQ Software Division remained seriously concerned about the volume of email going to their members that particular month.

Table 2: Public Survey Statistics

	Survey 1			Survey 2			Survey 3			Total		
Source	**Sampled**	**Responded**	**Response %**	**Sampled**	**Responded**	**Response %**	**Sampled**	**Responded**	**Response %**	**Sampled**	**Responded**	**Response %**
ASQ Reliability Division members	789	68	9	789	105	13	789	79	10	2,367	252	11
ASQ Software Division members	689	0	0	689	0	0	689	2	0	2,067	2	0
SEI staff	196	25	13	205	26	13	200	28	14	601	79	13
Local INCOSE members	34	2	6	30	4	13	28	3	11	92	9	10
Totals	1,708	95	6	1,713	135	8	1,706	112	7	5,127	342	7

Table 3 characterizes similar data for the AO surveys. Most evidently, the overall response rate for the AO surveys (12%) was almost twice the response rate of the public (7%) in keeping with the passionate focus that AOs have on this topic as compared to general members of the public.

Table 3: Alert Originator Survey Statistics

Source	Survey 1			Survey 2			Survey 3			Total		
	Sampled	Responded	Response %	Sampled	Responded	Response %	Sampled	Responded	Response %	Sampled	Responded	Response %
Alert Originators	168	18	11	193	31	16	199	17	9	560	66	12

11 Analysis of the Surveys

11.1 Limitations of the Surveys

We remained sensitive to a number of issues involved in creating successful surveys. This section addresses some of these issues and describes how we decided to handle each issue.

Data collection method. We decided to use multiple-choice surveys as a means of gathering quantitative feedback on specific trust scenarios. This approach met the schedule and budget constraints of the project. Given more time and budget, we could have asked open-ended questions along with multiple-choice questions in an effort to explore the respondents' thinking and learn more about specific trust factor interactions.

Respondent effort. We were sensitive to how long a given interview could last or how many questions a survey could have to keep a respondent engaged in providing accurate answers. As a result of this analysis, we divided the total set of questions for each BBN trust model into three different surveys, which resulted in very low dropout rates for the surveys.

Question wording. We knew that terminology would be critical with the survey questions. As a result, we avoided most acronyms and cryptic terms used in the emergency notification domain and used brief but concrete terms describing alert situations. Piloting the wording of survey questions with internal SEI staff provided invaluable assistance in rewording problematic survey questions prior to use with the thousands of planned survey recipients.

Order. We considered the ordering of questions as a factor to evaluate. Although the Qualtrics survey toolset allowed for the randomization of question order, we decided against such extreme measures and manually reviewed each survey for issues with question order and question relationship. In some cases, we moved highly related questions to separate surveys.

Format. Although we initially sought to include cell phone screen pictures within the survey questions, the limitations of the Qualtrics tool to use only Rich Text Format for questions led to the creation of textual WEA alerts with nuances highlighted with bold and font-size changes. Again, the internal piloting of the questions with SEI staff provided many instances of improvement regarding question formatting.

Structure. We kept the structure of the surveys simple to a linear list of questions without logical jumping. The only conditional flows in the surveys related to the early questions required as part of the human-subject research guidelines. If respondents answered in the negative to any of the questions discussed in Appendix A, the Qualtrics tool would then flow immediately to a thank you screen before exiting the survey. We did highlight to the respondent in advance the consequence of answering in the negative for any of the three human-subject research questions so that respondents would not find themselves refused from taking the survey by mistake.

Visual layout. We made a concerted effort to reduce, if not eliminate, required scrolling by a respondent within the web browser window during the survey activity. Ideally, respondents would take the survey mostly by mouse clicks so that the survey time could be reduced accordingly.

We remained vigilant in addressing both the validity (e.g., accuracy) and reliability (e.g., consistency) of the surveys. We addressed the following aspects within the context of overall threats to validity [Campbell 1963]:

- **Sample representativeness.** Controlled access to respondents' email addresses heavily influenced the sampled group of respondents, so follow-up on nonrespondents could occur. Thereby, the survey did not have a completely self-selected sample. However, the respondent sample taking the public trust survey were admittedly biased from the U.S. population socioeconomic status, since most respondents were members of the ASQ Reliability Division. This bias warrants scrutiny in follow-on research by ensuring the polling of a sample with educational backgrounds and socioeconomic status more representative of the U.S. population. With regard to the AO population, we deemed the sample to be representative, as the email addresses came from a collection of AO conference and workshop venues from across the country.
- **Survey design.** We made every attempt to design the survey questions such that they resembled a real-life experience of an emergency alert notification. Consequently, we believe the questions did achieve the desired measurement and assessment. However, one specific aspect of the questions included a concern for the public's reaction to alert messages that might contain spelling or grammatical errors. We incorporated errors into the scenario messages in the survey, but many of our respondents assumed that we made the error in constructing the survey question rather than that the error truly occurred in a WEA alert. As a result, we are less confident about the results depicting little impact on WEA trust due to spelling and grammatical errors. This aspect warrants further attention in subsequent research.
- **Face validity.** We expended a significant amount of effort creating hypothetical emergency alert scenarios and actual messages for use in the surveys to help ensure face validity. We believe the realism in the messages came as close as one could come to conducting observational research of real-life situations.
- **Content validity.** Although we did not conduct a statistical test of the content validity, we felt that the survey questions were concise and crisp, so that the specific trust factor(s) within the question were dominant and not masked or otherwise confused with other factors or side issues. In a further attempt to address content validity, we bolded and increased the font of specific words in each question to help the respondent realize the nuanced difference between similar questions. The internal testing of the questions within the SEI surfaced the confusion and challenge of answering the questions properly without the bolding and larger font.
- **Internal validity.** To increase confidence that the survey questions can really explain the outcome we want to research, our survey design included pairs of questions for most cause–effect relationships in the BBN trust models. For example, if we hypothesized that a given factor (prior knowledge of WEA) influenced belief in the WEA message, we asked one survey question with a scenario involving significant prior knowledge of WEA followed by a second question with a scenario involving little to no prior knowledge of WEA.
- **External validity.** To maximize the extent to which we could generalize the results to the target population, we identified multiple subpopulations to canvas with the public trust surveys. We intended to analyze the external validity statistically by compared results across subpopulations, but the sample sizes precluded this test. Follow-on research efforts should

further test the external validity by identifying a completely different set of subpopulations to canvas with the surveys.

From a reliability standpoint, we were concerned with the consistency of measurement using the surveys. Although not studied statistically as a rater reliability or repeatability/reproducibility exercise, the internal iterations of the survey questions under review by the SEI staff provided informal feedback on reliability. This aspect of the above-mentioned additional statistical tests would be the most practical to introduce in any follow-on modeling work.

11.2 Survey Descriptive Statistics

We provide the descriptive statistics related to the public surveys in Appendix N and the corollary material for the AO surveys in Appendix P. In both appendices, we include the original ordinal survey results followed by the conversion to a continuous scale of probability. We accomplished this conversion with the arbitrary midpoints of each range identified at the beginning of each survey and recreated here for convenience:

Definitely Not	I would respond to the situation less than 5% of the time
Very Probably Not	I would respond to the situation 5–20% of the time
Probably Not	I would respond to the situation 20–40% of the time
Undecided	I would respond to the situation 40–60% of the time
Probably	I would respond to the situation 60–80% of the time
Very Probably	I would respond to the situation 80–95% of the time
Definitely	I would respond to the situation more than 95% of the time

11.3 Analysis of the Surveys

We show the analysis of the public trust surveys in Appendix O and the analysis of the AO trust surveys in Appendices Q and R. Of special note, Appendix O shares the comparative tests for 20 different relationships within the public trust model. Of the 20 relationships tested, only 7 had low *p* values indicating significantly different influences on an outcome factor based on an originating causal factor. Thus, for the public model, a minority of the cause–effect relationships had strong statistical differentiation of outcomes based on causal factor behavior. As a result, a small subset of causal factors drives the differentiation of outcome probabilities of Hearing, Understanding, Believing, and Acting. The *Trust Model Simulations for the Wireless Emergency Alerts (WEA) Service* and *Maximizing Trust in the Wireless Emergency Alerts (WEA) Service* reports will cover these relationships in further detail. Appendices Q and R share the statistical comparisons related to relationships within the AO trust model. The comparisons here were counter to the public trust comparison tests. For the AO trust model, of the 36 comparative tests performed, 29 demonstrated statistically significant behavior of outcome factors based on changes to the causal factors. As a result, the AO trust model has more capability of depicting differentiated probability outcomes based on different scenarios of causal factors than the public trust model. From a research standpoint, this difference in survey outcomes may be rooted in the nature of the respondents. We would expect AOs to be more aware and sensitive to causal factors within the trust model than average members of society. However, further work in this area should include consideration of these noted causality differences.

12 Quantified Modeling Relationships

To quantitatively define most relationships in the BBNs, we used a pair of questions that together elicited information about the outcome factor based on the two extreme settings of the preceding causal factor. This approach kept the elicitation process plausible within the given schedule and budget constraints and the combinatorial explosion of multiple causal factors jointly driving a common outcome factor. We decided that we could best approximate the joint conditional probability of a given outcome factor by a weighted combination of the individual relationships of causal factors. Anticipating that this approach could overlook important interaction effects of multiple causal factors on an outcome factor, we decided to design validation scenarios that would provide the opportunity to surface any significant interaction effects. As we show in Section 13, the statistical analysis relating the BBN outcome factors to the validation scenarios provided a transformation function intended to account for the interaction effects.

During initial model prototyping, we learned that a simple weighted average approach to combining information of multiple causal factors proved insensitive to the effects of a single causal factor on the outcome factor. The effect of averaging 7–12 causal factors masked the individual impacts expected of single causal factors. As a result, we decided to employ a weighting scheme using the inverse of the factor's value to weight each causal factor. Thus, causal factors with smaller probability values would have a greater impact on the determination of the probability of the outcome factor. Trial scenarios of one or two causal factors with low probability values combined with three to five other causal factors with high probability values demonstrated that this approach added sufficient sensitivity to the BBN model outcomes.

Further research is still warranted to determine a more optimal approach to combining multiple causal factors to drive a single outcome factor. Additional research should focus more closely on how SMEs and members of the public consider multiple items of information when determining whether to understand, believe, and act on WEA alerts. Without expending more energy on this particular line of research, we decided that the inverse weighting scheme provided the needed amount of sensitivity to serve as a useful model of trust for this project.

13 Validation Interviews

After creating the BBN and using survey data to calibrate it, we initiated a validation process for the resulting models for the purpose of ensuring that they provided a sufficiently accurate representation of reality.

For the AO BBN, we created scenarios to exercise 18 trust factors of the model. We gave each factor a binary attribute; for example, Training was either sufficient (+) or insufficient (–), and Availability was either high (+) or low (–). Clearly, it was impractical to develop scenarios to address all combinations of trust factor values; this would have resulted in 2^{18} test cases. Instead, we chose to categorize the factors in seven groups, as shown in Table 4. Within each category, we used fractional factorial methods from statistical design of experiments to develop a series of test cases addressing the factors of each category. This resulted in the seven scenarios encompassing the 84 test cases shown in Table 4. Appendix Y provides the actual validation scenarios.

Table 4: AO Trust Model Validation Scenarios

#	Factors	Cases							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	Training	+	+	–	–				
	Cybersecurity	+	–	+	–				
	Governance	–	+	+	–				
2	Feedback from prior alerts	+	+	–	–				
	Public awareness	+	–	+	–				
	Alert frequency	–	+	+	–				
3	Availability	+	+	+	+	–	–	–	–
	Accessibility	+	+	–	–	+	+	–	–
	Reliability	+	–	+	–	+	–	+	–
	Ease of use	+	–	–	+	–	+	+	–
4	Timeliness	+	+	–	–				
	Understandability	+	–	+	–				
	Accuracy	–	+	+	–				
5	Urgency	+	+	–	–				
	Severity	+	–	+	–				
	Certainty	–	+	+	–				
6	Geographic breadth	+	–						
7	Time of day	+	–						

Based on these test cases, we developed a validation questionnaire that solicited the respondents' actions for each of the test cases. Appendix Z reproduces the questionnaire.

We contacted nine public alerting SMEs to validate the model. We interviewed each using the questionnaire; captured the results; and analyzed them to identify the mean, median, and variance of the response.

We input these same scenarios into the BBN and compared the results with the SMEs' responses. The graphical results of the validation surveys appear in Appendix AA. For example, Case 5 shows a pronounced difference in AO response between a scenario of high urgency, high severity, and low certainty as compared to a scenario of low urgency, low severity, and low certainty. We show the subsequent statistical analysis of the AO validation activity in Appendix AB, which comprises

- a table of data with pairings of the BBN model predictions versus the validation interview results
- a scatterplot of the pairings depicting a rough linear relationship
- the actual linear regression output depicting an adjusted r^2 value of 58% and a low p value indicating a statistically significant result
- four customary residual plots confirming proper normality and lack of ordered patterns in the residuals associated with the regression model.

The data shows that a statistically significant but moderate linear relationship exists between the utilization prediction from the AO BBN compared to the result of the validation survey scenario. A resulting "validation" linear regression model developed from this comparison produced the following equation:

$$\text{Validation} = -357 + 11.1\ \text{BBN}$$

This equation relates the BBN model predictions to the outcomes of the validation interviews of scenarios as follows: Multiply the BBN prediction of the probability of using the WEA system for a given scenario by 11.1, then subtract 357 to arrive at the expected probability ascertained via the validation interview. As discussed earlier, the validation equation that relates the BBN model to the results of the validation interviews attempts to account for interaction effects of factors not realized in the model as well as any bias of the validation interviews. Consequently, additional validation interviews could confirm this relationship or modify it based on a broader set of AO inputs.

We used the same process to validate the public trust model. We created scenarios to exercise 35 trust factors of the model. We gave each factor a binary attribute; for example, the Action to be taken was either specified (+) or unspecified (–), and the Message confirmation from other sources was either available (+) or unavailable (–). Again, it was impractical to develop scenarios to address all combinations of trust factor values; this would have resulted in 2^{35} test cases. Instead, we chose to categorize the factors in nine groups, as shown in Table 5. Within each category, we used fractional factorial methods to develop a series of test cases addressing the factors of the category. This resulted in the nine scenarios encompassing the 244 test cases shown in Table 5. We show the scenarios in greater detail in Appendix U.

Table 5: Public Trust Model Validation Scenarios

#	Factors	Cases							
		1	2	3	4	5	6	7	8
1	What has happened	+	+	–	–				
	Who should act	–	+	+	–				
	Why you should act	+	–	+	–				
2	Action to take	+	+	+	+	–	–	–	–
	Time to act	+	+	–	–	+	+	–	–
	Who should act	+	–	–	+	–	+	+	–
	Lead time	+	–	+	–	+	–	+	–
	Relevance	–	+	+	–	–	+	+	–
3	Alert type	+	+	+	+	–	–	–	–
	Alert frequency	–	–	+	+	–	–	+	+
	Public outreach	+	–	+	–	+	–	+	–
	History or relevance	+	–	–	+	–	+	+	–
4	Relevance	+	+	–	–				
	Clarity	+	–	+	–				
	Confirmation	–	+	+	–				
5	Coordination	+	+	–	–				
	Confirmation	+	–	+	–				
	Interpreted as spam	–	+	+	–				
6	Coordination	+	+	+	+	–	–	–	–
	Clarity	+	+	–	–	+	+	–	–
	Language	+	–	+	–	+	–	+	–
	Multiple communication channels	+	–	–	+	–	+	+	–
7	What has happened	+	+	+	+	–	–	–	–
	Why you should act	+	+	–	–	+	+	–	–
	Relevance	+	–	+	–	+	–	+	–
	Clarity	+	–	–	+	–	+	+	–
	Confirmed in social media	–	+	+	–	–	+	+	–
8	Confirmation	+	+	+	+	–	–	–	–
	History of relevance	+	+	–	–	+	+	–	–
	Coordination	+	–	+	–	+	–	+	–
	Public outreach	+	–	–	+	–	+	+	–
9	"All clear" message	+	+	+	+	–	–	–	–
	Alert source	+	+	–	–	+	+	–	–
	Alert frequency	+	–	+	–	+	–	+	–
	References	+	–	–	+	–	+	+	–

Based on these test cases, we developed a questionnaire that solicited the respondents' actions for each test case. We reproduce the questionnaire in Appendix V.

We empaneled a group of eight representatives of the public to validate the model. We chose representatives from the staff of the SEI who were not necessarily familiar with the WEA program or the WEA research being performed by SEI. We presented the questionnaire to the panel and collected the individual responses. Appendix W summarizes the graphical results of these validation scenarios. We analyzed these results statistically to identify the mean, median, and variance of each response.

We input these same scenarios into the BBN and compared the results with the panel responses. The public BBN validation employed a similar statistical analysis to the one conducted for the AO validation activity. We show the statistical analysis in Appendix X. Again, the linear regression analysis conducted depicts how we converted the probability predictions of different outcomes in the public BBN to align with the results of the public validation scenario results.

Specifically, for each outcome in the public BBN (Relevance, Acting, ViewSpam, OptOut, Understand, and Believe), we present

- a table of the paired data from the BBN prediction and the results of the validation survey scenario
- the scatterplot of the same data
- the statistical linear regression output
- the customary residual analysis associated with each regression equation

In summary, we derived the following statistically significant equations to convert the BBN model probability prediction to the probability assessment from the validation scenarios:

Acting-V = –6.04 + 11.6 Acting-B

Believe-V = –6.35 + 12.7 Believe-B

ViewSpam-V = –0.407 + 2.09 ViewSpam-B

The attempted linear regression associations of the Relevance, Opt-Out, and Understand factors did not produce significant statistical results. Several reasons again include the sample size of the data, the lack of appropriate modeling of factor interactions leading up to these outcomes, and the bias of the validation interviews conducted for this project for these specific outcome factors. As a result, more validation scenarios involving factors that influence Relevance, Opt-Out, and Understand factors would be helpful. These characteristics of the study could very likely produce variation prohibiting a statistical relationship between the BBN and the validation scenario outcomes. Nevertheless, we could reasonably relate the relationship between the probability of Acting on a WEA alert to the validation interview results for the set of validation scenarios.

14 Conclusions and Future Work

This task uncovered a rich legacy of research into the public's response to emergency notification systems in the literature search. As a result, the focus of this task centered on the measurement and modeling of a varied set of factors thought to impact trust in the WEA system. The surveys used in this project appeared to be a viable mechanism to gauge the public's reaction to different scenarios by describing scenarios in realistic fashion and asking members of the public and AO community to assess their likely responses. Testing the surveys ahead of time convinced us to move away from abstract, hypothetical questions to the evaluation of more realistically defined scenarios representing potential WEA alert situations. The probabilistic modeling appeared to provide the requisite ability to quantify the uncertainty in expert judgment and potential cause–effect relationships among a myriad of factors influencing trust in the WEA system. The greatest challenge, however, in the survey and modeling approach was the ability to confidently cover the space of interactions of different factors affecting trust. Although fractional factorial design of the validation cases enabled a sense of coverage during the validation phase, both sample-size limitations and the inability to reflect complex scenarios in a survey instrument presented challenges to the modeling effort.

The approach of interviewing emergency notification experts to explore potential causal factors of trust followed by the distribution of surveys to help confirm causal factors helped contribute to the knowledge of factors affecting trust in the WEA system and provided a framework for follow-on research. The intent of the modeling approach in this project remained twofold: (1) to provide short-term feedback on factors affecting trust in the WEA system and (2) to provide a framework to leverage ongoing research into trust factors, such that the growing body of knowledge of trust may be operationalized and shared.

As discussed earlier, this model could easily incorporate ongoing research into factors affecting trust in the WEA system and provide richer understanding and prediction of trust scenarios. Specifically, observational research could serve to confirm relationships that we discovered in this project and, more importantly, to help the emergency management field understand more complex scenarios of combined factors driving trust. Additionally, this modeling could be readily expanded to accommodate specific segments of the population, geographic areas of the country, and the host of factors purposely excluded from this project, namely, the set of factors deemed uncontrollable to participants and stakeholders of the WEA system. We hope that the modeling approach in this project will motivate future researchers to use such probabilistic modeling to operationalize causal relationships in a fashion enabling stakeholders and members of the public to both understand and believe the trust model results.

The probabilistic trust models in this report may be readily updated and used within future research in several simple ways. First, various forms of cause–effect modeling may be used with experts in the future to revisit the relationship of causal factors to the outcome of trust in the WEA system. Such cause–effect modeling may include cause–effect matrices as used in this project, Ishakawa ("fishbone") diagrams, reconstruction of actual trust situations, additional interviewing and observation of emergency notification staff and members of the public, and review of ongoing research literature. Second, but much more challenging, future research could use controlled experiments that expose live subjects to emergency notification scenarios and record and analyze their behavior. As seemingly prohibitive as this might sound, such research could employ methods not unlike the monitoring of household viewing experiences for the Neilson television ratings.

In general, researchers can design BBN probabilistic models to learn over time as streams of data from real life are fed into the models. Both the “prior” distributions and “likelihood” or “joint likelihood” distributions may be revisited based on ongoing experiences and observations. Similarly to the learning mechanisms within email spam filters, these BBNs could learn from either continuous streams of data or batches of data over time. The primary challenge would be to define the desired learning process and secure the commitment of responsible organizations to provide the ongoing recorded data from emergency notification scenarios.

As noted earlier, the primary limitations of this project’s modeling approach to trust in the WEA system rests in the challenge to analyze the truly expected response to the WEA system, whether it be an AO contemplating initiating a WEA alert or a member of the public responding to such an alert. The key question remains: How differently does actual behavior vary from the response to a scenario within a survey or interview? Research indicates that humans overestimate positive or desirable outcomes and underestimate negative or unwanted outcomes. Consequently, the survey approach of hypothetical scenarios may underestimate the effects of some of the negative trust factors and overestimate the effects of some of the positive influences on trust. Future research will need to be cognizant of this and investigate the human response accordingly.

Appendix A Human-Subject Research Application and Approval

Human-Subject Research Application

Carnegie Mellon University

For IRB Office Use
IRB No:____________
Rec'd:______________

APPLICATION FOR IRB REVIEW OF RESEARCH INVOLVING HUMAN SUBJECTS

(Not for exempt research)

Please complete this application as thoroughly as possible. Your application should include the following:

1. A consent form using the current CMU template that the participants and/or parent/guardian will be required to sign.
2. A copy of any questionnaires, surveys, images, de-briefings that will be used.
3. A copy of any recruitment documents (including advertisements, flyers, letters, invitations, email) to be used;
4. A copy of the training certificates for all individuals working on the research unless they are on file with the CMU IRB. Training is available at: http://www.citiprogram.org. See the IRB website for details.
5. If the PI is a student, the faculty advisor must submit a Faculty Advisor Assurance Form.

Please email all documents to irb-review@andrew.cmu.edu. For assistance call the CMU Office of Research Integrity and Compliance @ 412-268-5460 or email irb-review@andrew.cmu.edu. Additional information and templates are available at http://www.cmu.edu/osp/regulatory-compliance/human-subjects.html

1. Protocol		
Title: Wireless Emergency Alert System Trust Model		
☐ This is a previously approved study that has lapsed.	Previous IRB No: HS	
2. Principal Investigator (PI)		
Name: Robert W. Stoddard II		Department: SEI / SEPM
Telephone: 412-268-1121	E-mail: rws@sei.cmu.edu	Training Cert. ☐ Attached ☒ On File
☐ I am a student. If so, please provide information about your faculty advisor below.		
Faculty Advisor Name:	E-mail:	Training Cert. ☐ Attached ☐ On File
If a student is the PI, the faculty advisor must complete and submit a Faculty Advisor Assurance Form.		
If there is someone other than PI to correspond with regarding this protocol, please list below.		
Contact Person Name:	Telephone:	E-mail:
Business Manager for your department:		E-mail:
3. Co-investigators		
Name:	E-mail:	Training Cert. ☐ Attached ☐ On File
Name:	E-mail:	Training Cert. ☐ Attached ☐ On File
Name:	E-mail:	Training Cert. ☐ Attached ☐ On File
Name:	E-mail:	Training Cert. ☐ Attached ☐ On File
Name:	E-mail:	Training Cert. ☐ Attached ☐ On File
Name:	E-mail:	Training Cert. ☐ Attached ☐ On File
Name:	E-mail:	Training Cert. ☐ Attached ☐ On File
4. Funding		
☐ Unfunded research	☒ External Funding	☐ Internal Funding
Sponsor/Source: ☐ NSF ☐ NIH ☒ Other, please specify: US Department of Homeland Security		
Grant Title: PWS 5-308J for contract FA8721-05-C-0003 between SEI and DHS		
If federally funded, is this application consistent with the grant? ☒ Yes ☐ No		
Is CMU the prime recipient of funding? ☒ Yes ☐ No	Is CMU a sub-recipient? ☐ Yes ☒ No	

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Carnegie Mellon University

For IRB Office Use
IRB No:______________
Rec'd:__________________

☐ SPEX Proposal #:	☐ SPEX Award #:
If you don't know the funding/grant information, please get it from your department's business manager.	

5. Protocol Description	
a.	Provide, in lay terms, a summary of your proposed study as outlined below. You may attach the protocol to this form if you like. This research includes a study and probabilistic model of the factors which may influence both the public trust and the alert originator trust in the new United States Wireless Emergency Alert (WEA) system, formerly called the Commercial Mobile Alert System (CMAS). Our team was asked to leverage existing research and collect any new additional data that would enable such a quantitative model of trust that would, in turn, be used to develop heuristics guiding the alert originators and owners of the WEA system in what conditions and actions to be aware of that may degrade trust in WEA. This remains an important research activity to help ensure a successful deployment of WEA in the United States during the summer of 2013. Our specific research activity involving HSR lies in the planned conduct of online surveys to approximately 5000 members of the public and approximately 800 members of the alert origination community across the country.
b.	What is the purpose of the study (what is your research question) and how will the data collected be used? The survey questions will enable our research team to quantify the probabilistic relationships in a Bayesian Belief Network (BBN) trust model that we have developed to predict the likelihood an alert is heard, understood, believed and acted upon.
c.	Describe the research procedures (include the activity(s), location(s) and time required of the participant).Online surveys will be issued during March to the employees of the Software Engineering Institute (~600), members of a local engineering society (~60) and members of the American Society for Quality Software and Reliability divisions (~4300). The respondents will be given approximately three weeks to complete the online surveys. The online surveys will be taken by participants at any internet connection of their choice. Each survey is expected to take no more than 5-8 minutes.
d.	Who will be asked to participate?SEI employees, local engineering society members and members from the American Society for Quality
e.	Will questionnaires or surveys be used? ☒ Yes ☐ No If yes, please attach.
f.	Will tasks be done on a computer? ☒ Yes ☐ No If yes, how will the tasks be accessed? ☒ Remotely via the internet? ☐ In the research lab? ☐ Other, please explain:
g.	Will deception be used? ☐ Yes ☒ No If yes, describe how participants will be debriefed. Please include the de-briefing material and/or script.
h.	In what country will the research be conducted (check all that apply)? ☒ United States ☐ Qatar ☐ Other country, please list:
i.	Will the research be conducted on a CMU campus? ☒ Pittsburgh ☐ Silicon Valley ☐ Qatar ☒ No If no, please indicate the location(s). Non-CMU participants will be taking this online survey through any internet connection of their choice using a link provided by the Qualtrics invitation email. *If applicable, please attach documentation of permission to conduct research in private, non-CMU space.*
6. Participants	
a.	Will any of the following classes of vulnerable subjects be involved in the proposed study? *(check all that apply)*

Class	*Comments*
Pregnant women, human fetuses ☐ Yes ☐ No ☒ Pregnant women will not be specifically included or excluded. (See http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.htm, research that is incidental to pregnancy and has no risk to the fetus can only include pregnant women if ALL aspects of Subpart B are met.)	We will be using provided email lists with no knowledge of whether individuals are or are not pregnant.

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Neonates ☐ Yes ☒ No	
Prisoners ☐ Yes ☒ No	
Children ☐ Yes ☒ No	
b. Individuals with compromised mental status ☐ Yes ☒ No If yes, indicate how this will be determined.	
c. Will the participants be capable of understanding the nature of the study and the consent process? ☒ Yes ☐ No If no, explain.	
d. What is the age range of participants in the proposed study? 18-75	
e. How many participants are needed for the study? 5000 How was that number determined?3 different public surveys with 200 respondents each and assume a 14% response rate (4200 total needed); additionally two alert originator surveys with 200 respondents each and assume a 50% response rate (800 total needed)	
f. What do you estimate the ratio of males to females to be? 50% Will this be reflective of the local population? ☒ Yes ☐ No Will you target a certain population? ☒ Yes ☐ No Please explain The only targeting that we are doing is to have the public respond to the public survey and the alert originator community to respond to the alert originator survey.	
g. Do you anticipate that your participants will represent a cross-section of the population in the region where the study is being conducted? ☐ Yes ☒ No If yes, please describe and estimate the percentage that will be from minority groups. If no, please describe your study population and address why minority representation is not considered. Our study population consists of members of the public without regards to minority status and focuses on a narrow set of attributes that the WEA Service can influence via the behavior of the WEA Service providers. We note that the email lists we have accessed are clearly biased towards the software and reliability members of the American Society for Quality. This scope will be clearly documented in the final report.	
h. Please list inclusion and exclusion criteria. Only alert originators will be allowed to take the alert originator survey. Other inclusion criteria will be age (18 yrs of age or older) and currently using some form of a cellular phone.	
7. Participant Recruitment	
a. Describe how participant recruitment will be performed. Include how and by whom potential participants are introduced to the study. Recruitment will be by email only based on assembled email lists.	
Check all boxes below that apply.	
☐ Flyers Where will they be posted?	
☐ Radio, TV	
☒ E-mail solicitation Indicate how the email addresses are obtained.Joe Elm is securing permission from the Director's Office via Linda Northrop to send out the email invites for the public survey to SEI employees. Joe Elm also just secured permission to send the survey email invites to about 60 local members of an engineering society. Robert Stoddard will secure written permission from the American Society for Quality to send out the survey invite emails to approx. 4200 ASQ members of the Reliability and Software divisions.	
☐ Web-based solicitation. Specify sites:	
☐ Participant Pool. Specify what pool:	
☐ Other, please specify:	
b. Will participants undergo screening prior to their participation? If yes, please describe.	
Please attach any recruiting materials you plan to use and the text of e-mail or web-based solicitations you will use.	
8. Consent	

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Rec'd:____________________

a.	Do you plan to use consent forms? ☒ Yes ☐ No If no, you must complete the section 8e below on waiver of informed consent. If yes, describe how consent will be obtained and by whom. We will include an online consent form at the beginning of the survey in which the respondent will then be required to check a consent box to continue the survey. Record of the consent info will be captured and retained by the Qualtrics survey software tool. Will consent be obtained online? ☒ Yes ☐ No If yes, you must request a waiver of written documentation below in section 8h.
b.	If participants are minors will assent forms be used? ☐ Yes ☐ No *If no, please explain.* ☒ *NA no minors*
c.	Will the consent form be presented on paper or online? ☐ Paper ☒ Online
d.	Are you requesting to use a consent format that is different from the CMU model consent? ☐ Yes ☒ No If yes, please explain.
e.	Are you requesting a **waiver of informed consent**? ☐ Yes ☒ No If yes, please explain how each of the elements listed apply to your request for a waiver: ▪ The research involves no more than minimal risk to the subjects; ▪ The waiver will not adversely affect the rights and welfare of the subjects; ▪ The research could not practicably be carried out without the waiver and ; ▪ Whenever appropriate, the subjects will be provided with additional pertinent information after participation. Explain:
f.	Is the waiver for all study participants? ☐ Yes ☐ No If no, to whom does the waiver apply?
g.	Is the waiver for all study procedures? ☐ Yes ☐ No If no, to what procedures does the waiver apply?
h.	Are you requesting a **waiver of written documentation** (signed) of informed consent? ☒ Yes ☐ No If yes, please indicate which one of the following applies: ☒ The only record linking the participant and the research will be the consent document and the principal risk to the participant harm would be from breach of confidentiality. ☒I consider this a minimal risk study that involves no procedures for which written consent is normally required outside of research.
i.	Explain how the study meets the criteria checked above. No one outside of the principal investigator will have access to the survey results in which personally identifiable information is recorded. The nature of the questions represents minimal risk to a respondent.
9.	**Risks and Benefits** (Note: payments to participants are not considered to be a benefit)
a.	Will participants receive intangible benefit from the study? ☒ Yes ☐ No
b.	Discuss the direct and indirect benefits to participants. They will receive some familiarity with the nature and content of alert messages that will eventually be issued to mobile devices based on geographic location.
c.	Discuss the risks to participants. One risk will be that the 17-20 questions may appear slightly similar and require concentration. A second risk will be "breach of confidentiality" from a standpoint of obtaining personal email addresses and the technical ability within the password controlled Qualtrics tools to map email addresses to individual responses.
d.	Discuss how any risks will be managed and/or minimized. We are limiting each survey to 17-20 questions that may be accomplished in about 5-8 minutes. We will not force respondents to answer individual questions so that they may skip one or more questions if needed. We will also control access to email addresses and individual responses by limiting access to the Qualtrics survey tool database by password. Content and results

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Rec'd:___________________

	will be saved in offline electronic media in a secured container so that the online Qualtrics content will be deleted to secure from any future inadvertant access.
e.	If deception is involved, please explain.
f.	Indicate the degree of physical or psychological risk you believe the research poses to human subjects *(check which one applies).* ☒ Minimal Risk: A risk is minimal where the probability and magnitude of harm or discomfort anticipated in the proposed research are not greater, in and of themselves, than those ordinarily encountered in daily life of during the performance o routine physical or psychological examinations or tests. ☐ Greater than Minimal Risk: A risk is greater than minimal where the probability and magnitude of harm or discomfort anticipated in the proposed research are greater than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.
g.	Describe how the study fits in this risk level. The survey is short in time (5 mins) and length (17-20 questions) and does not seek personal sensitive information.
10.	**Participant Compensation and Costs**
a.	Are participants to be compensated for the study? ☐ Yes ☒ No If yes, what is the amount, type and source of funds?

Amount:	Source:	Type (gift card, cash):

b.	Will participants who are students be offered class credit? ☐ Yes ☒ No If yes, please indentify the class and instructor.
c.	Are other inducements planned to recruit participants? ☒ Yes ☐ No If yes, please describe. We will offer all respondents an invitation-only webinar in the near future to provide more interesting details of the WEA system and it's general operations and purpose.
d.	Are there any costs to participants? ☐ Yes ☒ No If yes, please explain.
e.	Will you compensate participants for injury resulting from participation? ☐ Yes ☐ No ☒ NA If yes, please describe.
11.	**Confidentiality and Data Security**
a.	Will personal identifiers be collected? ☒ Yes ☐ No If yes, list the personal identifiers to be collected. The Qualtrics tools will maintain a linkage of a person's email address with a given survey response. Although this linkage is of not interest to the research, it will enable the survey software to issue reminder emails and control who is responding to the survey.
b.	Will identifiers be translated to a code? ☒ Yes ☐ No If no, indicate why.
c.	Will audio recordings be made? ☐ Yes ☒ No If yes, please describe.
d.	Will video recordings be made? ☐ Yes ☒ No If yes, please describe.
e.	Is the information so sensitive that you will obtain a certificate of confidentiality from NIH? ☐ Yes ☒ No
f.	Who will have access to data (surveys, questionnaires, recordings, interview records, etc.)? Only the principal investigator will have access to the Qualtrics survey results. Summarized results will be analyzed by the principal investigator for purposes of populating conditional probabilities in the BBN probabilistic model.
g.	Describe how you will protect participant confidentiality and secure research records (Will they be stored on a secure computer, locked cabinet, etc?). All paper records will be secured under lock and key in the department of the principal investigator. Electronic files of the survey results will be saved and archived to CD and stored

	with the paper records. All other online Qualtrics software files and results will then be purged once the storage media and paper is secure.
h.	Describe your process for monitoring data to ensure that study goals are met. (Review of lab notebooks, frequency of meetings to review data, who will be present at the meetings, how recruitment and retention will be monitored, etc.) This work will convene and last during the next three months, after which all records will be securely stored.
12. Conflict of Interest	
Do you or any individual who is associated with or responsible for the design, the conduct of or the reporting of this research have an economic or financial interest in, or act as an officer or director for any outside entity whose interests could reasonably appear to be affected by this research project? ☐ Yes ☒ No If yes, please provide detailed information to permit the IRB to determine if such involvement should be disclosed to potential research subjects.	
13. Cooperating Institutions	
a.	Is this research being done in cooperation with any institutions, individuals or organizations not affiliated with CMU? ☒ Yes ☐ No If yes, please list and describe their role in this research. SRA is on subcontract to the SEI to assist as necessary. Their primary role was an early influence on the structure of the probabilistic model and the collection and submission of the 800 alert originator email addresses to use for the survey.
b.	Have you received IRB approval from another IRB for this study? ☐ Yes ☒ No ☐ Pending If yes, please attach a copy of the IRB approval.
c.	If multiple institutions are involved in this study indicate who is responsible for oversight of the entire study. SEI
If applicable, please provide the name(s) and address(es) of all officials authorizing to access human subjects in cooperating institutions not affiliated with CMU. *Please attach documentation of approval.*	

Principal Investigator's Assurance Statement for Using Human Subjects in Research

I certify that the information provided in this IRB application is complete and accurate.

I understand that as Principal Investigator, I have ultimate responsibility for the conduct of IRB approved studies, the ethical performance of protocols, the protection of the rights and welfare of human participants, and strict adherence to the studies protocol and any stipulations imposed by Carnegie Mellon University Institutional Review Board.

I understand that it is my responsibility to ensure that the human participants' involvement as described in the funding proposal(s) is consistent in principle, to that contained in the IRB application. I will submit modifications and/or changes to the IRB as necessary.

I agree to comply with all Carnegie Mellon University policies and procedures, as well as with all applicable federal, state, and local laws, regarding the protection of human participants in research, including, but not limited to:

- Ensuring all investigators and key study personnel have completed human subjects training program;
- Ensuring protocols are conducted by qualified personnel following the approved IRB application;
- Implementing no changes in approved IRB applications or informed consent documents without prior IRB approval in accordance with CMU IRB policy (except in an emergency, if necessary to safeguard the well-being of a human participant, and will report to the IRB within 1 day of such change);
- Obtaining the legally effective informed consent from human participants or their representative, using only the currently approved date-stamped informed consent documents, and providing a copy to the participant.
- Ensuring that only IRB-approved investigators for this study obtain informed consent from potential subjects.

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Rec'd:___________________

- Informing participants of any relevant new information regarding their participation in the research that becomes available.
- Promptly reporting to the IRB any new information involving risks to research participants, including reporting to the IRB, Data Safety and Monitoring Boards, sponsors and appropriate federal agencies any adverse experiences and all unanticipated problems involving risks to human subjects or others that occur in the course of the research.
- If unavailable to conduct research personally, as when on sabbatical leave or vacation, arrangements for another investigator to assume direct responsibility for studies will be made through modification requests to the IRB;
- Promptly providing the IRB with any information requested relative to protocols;
- Promptly and completely complying with IRB decisions to suspend or withdraw approval for projects;
- Obtaining Continuing Review approval prior to the date the approval for a study expires (approval for the study will automatically expire);
- Maintaining accurate and complete research records, including, but not limited to, all informed consent documents for 3 years from the date of study completion;
- Informing the CMU IRB of all locations in which human participants will be recruited for protocols and being responsible for obtaining and maintaining current IRB approvals/letters of cooperation when applicable;
- Complying with federal, state and local laws and regulations and sponsor terms and conditions; and
- Complying with CMU policies on the responsible conduct of research.

Robert W. Stoddard ____________________ 1 March 2013__

Principal Investigator Name and Signature Date

Note: If e-mailed from the PI's CMU e-mail account a hand written signature is not needed. Please type in name and date. If the PI is a student, the faculty advisor must submit a Faculty Advisor Assurance Form.

Please email all documents to irb-review@andrew.cmu.edu.

Note: Links to the policies and Federal regulations for the protection of human research subjects (including the Code of Federal Regulations [.CF.R.] Title 45 CFR Part 46 and Title 21 C.F.R. parts 50 and 56) are available on the IRB web page (http://www.cmu.edu/provost/spon-res/compliance/hs.htm).

Comments:

CMU Internal Review Board Approval

Carnegie Mellon University

Institutional Review Board

Federalwide Assurance No: FWA00004206

IRB Registration No: IRB00000603

Office of Research Integrity and Compliance (ORIC)
Carnegie Mellon University
5000 Forbes Avenue
Warner Hall, 4th Floor
Pittsburgh, Pennsylvania 15213-3890
412.268.7166
irb-review@andrew.cmu.edu

Certification of IRB Approval

IRB Protocol Number:	HS13-137
Title:	Wireless Emergency Alert System Trust Model
Investigator(s):	Robert Stoddard
Department(s):	SEI/SEPM
Date:	March 29, 2013

Carnegie Mellon University Institutional Review Board (IRB) reviewed the above referenced research protocol in accordance with 45 CFR 46 and CMU's Federalwide Assurance. The research protocol has been given **APPROVAL by Expedited Review on March 22, 2013, as authorized by 45 CFR 46.110 (7) and 21 CFR 56.110. This APPROVAL expires on March 21, 2014,** unless suspended or terminated earlier by action of the IRB.

The IRB has granted a waiver of written documentation of informed consent for this study.

All untoward or adverse events occurring in the course of the protocol must be reported to the IRB within three (3) working days. Any additional modifications to this research protocol or advertising materials pertaining to the study must be submitted for review and granted IRB approval prior to implementation. Please refer to the above-referenced protocol number in all correspondence.

Federal regulations require that all records relating to this research protocol be maintained for **at least three (3) years after completion** of the research, and be accessible for inspection and copying by authorized representatives at reasonable times and in a reasonable manner.

The Investigator(s) listed above in conducting this protocol agree(s) to follow the recommendations of the IRB and the Office of the Provost of any conditions to or changes in procedure subsequent to this review. In undertaking the execution of the protocol, the investigator(s) further agree(s) to abide by all CMU research policies including, but not limited to the policies on responsible conduct research and conflict of interest.

The IRB maintains ongoing review of all projects involving humans or human materials, and at continuing intervals, projects will require update until completion. At the end of the current approval, a continuing review form, current application/protocol and current consent form(s) must be submitted by the PI to the IRB summarizing progress on the protocol during that period. Please be advised that the continuing review form requests information pertaining to women and minorities; therefore, this information should be tracked with your participants' data. **Note that submitting for continuing review in a timely manner is the responsibility of the PI.**

Please call the Office of Research Integrity and Compliance at 412-268-7166 if you have any questions regarding this certification. Thank you.

David Danks, Ph.D., IRB, Chair

Appendix B Interviews of Emergency Alert Notification Officials

Interview Questions

Concept of Trust

1. Do you have a means of assessing and/or predicting the confidence that the public will have in your alerts? If yes, please describe it.
2. What influences your decision to use a particular alert system? Please provide a specific example.
3. Have your methods of assessing the public's confidence in your alerts evolved over the years? How have they changed and why?

Alerting Experience

4. What methods do you use to issue alerts?
   - telephone to subscribers
   - email to subscribers
   - reverse 911
   - Twitter
   - Facebook
   - web site
   - EAS (Emergency Alert System)
   - outreach to media
   - other (please describe)
5. Have you consulted with anyone regarding ways to make your alerting system more effective? Who?
6. Do you have to coordinate with other organizations to issue an alert? Are there any problems in coordination?
7. Do you have any issues with the propagation of your alerts?
8. What criteria do you use to decide to issue an alert?
9. What type of alerts do you issue and how frequently?
10. Do you use multiple channels (e.g., email, telephone, EAS) to issue alerts containing corroborating information? How do you decide what to send through each channel?
11. How often do you have to revise or amend an alert (other than an "all clear" notification)? Are the updates always sent via the same channels as the initial alert? What guidelines or criteria do you use for updating alerts?
12. Would you please describe your process for changing how you issue alerts? What factors do you consider when making a change to your alert process?

Alert Effectiveness

13. What feedback do you get from issuing alerts, including feedback from the public?
14. Do you collect data on the responses to the alerts you issue? What data do you collect and how do you use it?

15. How do you determine the effectiveness of your alerts?
16. What causes the public to ignore an alert?
17. Do you receive acknowledgement receipts to alerts you issue? Are the acknowledgement receipts analyzed by you and have they influenced how you issue alerts?
18. How do you inform and educate the public regarding your alert system? How has that education affected the public's response to your alerts?
19. What should be done to improve alert systems? What would be the perfect alert system?
20. Regarding the content of an alert, what makes it effective? What makes it ineffective?

[WEA] Experience

21. How does [WEA] figure into your alert strategy? What do you see as benefits and detractions of using [WEA]?
22. Please describe any experience you've had with [WEA]? How has that worked? Was it effective?

Additional Questions

23. Are there any factors we've missed that you believe influence the public's trust in alerts?
24. Are there any factors that influence your use of an alert system, either positive or negative, that we have not covered?
25. Would you be willing to discuss this topic further with us? We would like to get more in-depth information about your experiences.

Thank you very much for your time and for sharing your expertise with us.

Summarized Notes from Interviews of Emergency Alert Notification Officials

Trust Model Benchmarking Interview Themes

- Interviews conducted 10/10/12–10/24/12
- Participant key:
  - MG
  - KH
  - LF
  - DM
  - FS
  - AC
  - LL
  - JF
  - RS

Overarching Compelling Themes:

1. Public response to alerts is directly tied to the relevance of alerts – [WEA]'s current geotargeting configuration makes it unlikely that AOs will disseminate relevant alerts to a majority of constituents in a given jurisdiction due to few incidents that have county-wide impact; more than one alert originator noted that the public is looking for more personal alerts and

more than one jurisdiction allows the public to customize their alerts [alert types, alerting time of day, location, etc.].

2. The public, in general, is not interested in subscribing to an alert service (reflected in low numbers); even with heavy promotion subscriber numbers are relatively low; AOs seem concerned that this lack of interest may translate into high opt-out rates, which could already be taking place due to NWS [National Weather Service] alerts.
3. Regarding [WEA], nationwide public education and AO education is essential to inform the public and gain its trust, prevent opt out from [WEA], and increase participation of AOs in [WEA] and their understanding of how the system works; appropriate education is not taking place, we are already “losing the battle.” Further, it is unclear who should take ownership of this process but it appears that collectively system owners and stakeholders are falling short at every level.
4. There does not appear to be consistency in how AOs are using different alerting tools. Some use reverse 911 as their primary tool for severe incidents, and SM is used for general awareness; others take the opposite approach. There is, however, consistency in that AOs think [WEA] is valuable in theory, but its current 90-character limit and county-level geotargeting capability limit its applicability and value right now.
5. **Concept of Trust**
   - Assessing public trust is inconsistent among AOs. Generally, however, AOs seem to rely on SM to some degree [this seems to offer somewhat more robust and positive data than more traditional means such as calls or emails], internal conversations, occasionally unsolicited feedback from the public via email, media commentary, and, rarely, formal studies or surveys. AOs do not appear to be recording or storing feedback or assessment data, except in the case of a formal study or survey.
   - AOs did not indicate that the public’s trust or feedback factors into the use or adoption of new systems; however, the fact that all AOs we spoke to mention some use of SM, which is now ubiquitous in the public realm, may indicate some correlation between direct or indirect feedback from the public and the adoption of new alert tools. Direct or indirect feedback does appear to have some influence over how current tools are used, when some tools are used, and the types of alerts that are issued, namely in the case of less severe events.
6. **Alert Experience**
   - There is a lack of consistency in how AOs are using popular alerting tools. For example, some use reverse 911 as their primary tool for severe incidents, and SM [social media] is used for general awareness; others take the opposite approach. All AOs employ more than one tool to alert and/or communicate emergency information to the public.
   - With the exception of NWS, AOs did not provide or indicate specific criteria for issuing or amending alerts beyond generalities such as “life safety impact” and “[event] will affect people.” Frequency of alerts varies widely and in many cases is dependent upon seasonal activity, such as wildfire or hurricane season.
   - Not all AOs amend or cancel alerts using the same tool employed for issuing the original alert. A few AOs stated that amending or canceling alerts was rare. A few AOs noted the importance of issuing a final communication to the public to close out an alert event.

- Overall, AOs did not report major concerns in the areas of coordination and propagation. It is worth noting, however, that due to the potential for message bleedover when using [WEA], one AO noted an expectation that there will be coordination challenges with neighboring jurisdictions.

7. Alert Effectiveness

- Public response to alerts is directly tied to the relevance of alerts – [WEA]'s current geo-targeting configuration makes it unlikely that AOs will disseminate relevant alerts to a majority of constituents. In a given jurisdiction, AOs indicate there are a few incidents that have a county-wide impact that merit issuing a [WEA] alert.
- The public, in general, is not interested in subscribing to an alert service (reflected in low numbers). Heavy promotion and education of local alerting services and processes, while not the norm, still results in a relatively low proportion of the public subscribing. Further, AOs seem concerned that this lack of interest may translate into high opt-out rates, which could already be taking place due to the large number of NWS [WEA] alerts and general lack of education regarding alerting generally and [WEA] specifically.
- Again, AOs do not appear to be recording or storing feedback or assessment data, except in the case of a formal study or survey feedback, as they noted when questioned regarding the assessment of public trust, is gathered generally via SM, internal conversations, unsolicited feedback from the public via email, media commentary, and, rarely, formal studies or surveys. Public acknowledgment or tracking of "acks" from the public is rare due to liability concerns and/or technology or staffing limitations.

8. [WEA] Experience

- AOs generally think [WEA] is valuable in theory, but its current 90-character limit and county-level geotargeting capability limit its applicability and value right now. AOs are taking a cautious approach to issuing [WEA] alerts and overwhelmingly believe the public has little to no knowledge about the service.
- AOs say nationwide public education and AO education is essential to inform the public and gain its trust in [WEA], prevent opt out from [WEA], and increase participation of AOs in [WEA] and level-set or enhance AOs' understanding of how the system works; appropriate education is not taking place, we are already "losing the battle." Further, it is unclear who should take ownership of this process but it appears that collectively system owners and stakeholders are falling short at every level.
- Most AOs' experience, including those who have adopted [WEA], is cited as experience with NWS's [WEA] weather alerts. Feedback here is inconsistent; some AOs worry that NWS is over-alerting and generally doesn't coordinate alerts with the jurisdiction well, and others plan to apply NWS's [WEA] lessons learned.

Summaries by Question

1. Do you have a means of assessing and/or predicting the confidence that the public will have in your alerts? If yes, please describe it.
   - AOs conduct surveys, formal or informal, following an incident/alert event (KH, MG)
   - Social media use is growing, important to keep viral messaging consistent somehow (MG)

- Related note – it is difficult to control who gets their alerts due to “a lot of spillover” (KH)
- Rely heavily on the media to mirror the message and provide follow up/more detailed information (KH)
- Public doesn’t understand how system works – disconnect between public’s use of alert system and officials’ (KH)
- AOs monitor feedback of mass notification system, road reports, media stories, as indicators of public taking the recommended alert action (FS)
- County-wide incidents are rare, [WEA] alerts are designed to be relevant to an entire county (FS)
- Methods don’t exist here…(AC)
- Outside of doing a survey via a (rare) third-party organization, we don’t assess for these types of alerts; we depend upon our feedback from third-party sources – newspaper coverage of large-scale events, how well did reverse 911 messages work, did public follow them, etc.; gather some social media (SM) feedback, our alerts are one way (LL)
- Really only have feedback from SM, including Twitter & Facebook, which makes it easier for the public to express their opinions; prior to SM, really only heard from people who wanted to complain (JF)
- Don’t have format to test it; do have historical email responses from the last 10 years (RS)
- [We have] sent out a few Survey Monkey surveys over last few years; 3–5 question surveys, going only to alert service subscribers (RS)
- Prompts to send surveys: the Mineral, VA Earthquake/Hurricane Irene/one additional weather event prompted [us] to send [our] most recent survey; typically received positive responses, information about technical issues, questions like “why didn’t you alert earlier?” or “message wasn’t clear to me” (RS)
- For feedback that highlights technical glitches and are a high-priority issue…we’ll follow up with customer first to determine if it is operator error; if there is a true issue with process or policy and we feel it really needs to change, we’ll change (RS)
- Email responses from subscribers [the public] can be sent to report issues; typically [we] get responses about big events, received comments on messaging around Sandy, the Derecho – these comments were more about technical glitches with phones, devices to which the public has subscribed to receive alerts, and not responses to the actual messaging from [our office] (RS)

2. Have your methods of assessing the public’s confidence in your alerts evolved over the years? How have they changed and why?
   - Continuing to survey (conduct outreach/town halls instead depending on event) (KH)
   - Wordsmithing messages gone wrong in the middle of events (KH)
   - More impact-oriented alerts; more methodical surveying, surveying more often, follow up on survey lessons learned more consistently, factoring in changes to alert dissemination methodology (MG)
   - Continuing to focus on effective ways to communicate information (MG)

- AOs need to build trust well ahead of time prior to when we actually issue the alerts; direct engagement with the public is key to completing this activity (FS)
- We recently (five years ago) established public notification office tasked with directly communicating with the public; previously communications were routed through the media (FS)
- Communication is conducted through the alerting system, SM, and our website (FS)
- Methods don't exist here (AC)
- We've looked at what works and didn't; looking at new vendor (LL)
- Exploring new means/tools to communicate with public; looking into systems that can take our message and translate/convert into more languages (LL)
- Don't have a way to assess public's confidence in alerts; when conducting my thesis, I found very little confidence in the government at that time; anticipate this confidence will grow as we shift from a one-size-fits-all approach to using more alerting methods (JF)
- We have tried to increase transparency and get the community's input on tasks we previously conducted internally (JF)
- We typically do an after-action program on any exercise or big event for which we stand up the emergency operations center (EOC); the Derecho was so significant that the board of supervisors asked us to expand and reach out to the community; we sent a Survey Monkey of 15 questions to county's resident distribution lists (e.g., home owners associations); also surveyed via the board of supervisors and chambers of commerce's distribution lists; focus of survey was on how message was received…received approximately 19,000 responses on questions about alerting throughout the whole 4–5 day event; responses included (RS):
  - Concerns that messages didn't go out soon enough (8.30pm warning for a 12AM event)
    - We don't have 24-hour program in [our city], more timely information would require a 24-hour agency
  - Alerted the public using the "whole shebang" – Twitter, press conference, text alerts, etc.
  - Public complained they didn't have power, didn't get messages – many tools with SM, alert network, Channel 16 in county, highway advisory radio—also have a full system of 7 towers dedicated to emergency messaging (don't advertise this service, little response/interest by the public)
  - Some people just weren't paying attention; had power and received SM messages; got messages continually because members of public were charging devices outside the home (RS)

3. What influences your decision to use a particular alert system? Please provide a specific example.
   - We establish tool for disseminating information and are reluctant to sway from it – want public to see consistency in how/which tool they receive messages about particular events (MG)

- Focus on making our data readily accessible – multiple sources that can be tweeted, etc. (MG)
- We need control over exactly what events we alert about (e.g., EAS is predetermined by FCC); forecasters don't have direct control over parameters we'd use for [WEA] (urgency, severity, certainty) (MG)
- Put control of how messages are rendered in hands of the receiver (they decide which levels they want to be alerted of) (MG)
- Accept inconsistency in how alerts are disseminated (some at county level, some below) due to carrier inconsistency – usually issuing [WEA] alerts via polygon, not FIPS (MG)
- Concerned about irrelevant alerts reaching public, due to county level geotargeting (MG)
- Use [WEA] for short fuse events; also use EAS because it will reach more people during a short fuse event; longer fuse event – there is more time to get an alert out through other methods (MG)
- Focused on acquiring tools only if they are interoperable with current system, eliminate additional steps either manually or with policy – one-click use (KH)
- We use a tiered approach tied to how localized an event is: SM and website is for general awareness, then alert system, then EAS to "yell at everyone to listen" (FS)
- We house our own opt-in alerting system [own the database of users/subscribers] and only use vendor as gateway; we don't want to be dependent on the vendor, want to own our data (AC)
- We want portability and options on the go (AC)
- [WEA] is an amazing tool, will allow us to reach all of our tourists (AC)
- Timing – if we do not have much time and the event is fast moving we may use EAS; if there is time to geotarget, we will send out through our alert service; if there is time to add additional languages, we'll do that also (LL)
- There is no one service that reaches everybody; looking at redundant systems; we want to get to the point that I enter data into one mechanism and the alerts go out to all our systems (JF)
- [A government agency] did an RFI earlier this year to look at other systems out there, concluded some others may be better and provide capabilities we don't currently have…it is a huge project, tied in with the [state], military and federal entities, [and regional authorities]; federal government also requires that power plants need a nuclear alert system; full requirements document has been created – 45 items – calls for GIS mapping, report out capability, reverse 911 feature, CAP 2.0 compliancy for [WEA], etc. (RS)
- Cost is a concern – UASI funding to end in the next couple years (RS)

4. What type of alerts do you issue and how frequently?
   - Alerts for large-scale incidents are rare (KH)
   - Most alerts are high in urgency and severity in small geographic area (KH)
   - Short fuse alerts – up to approximately 700 in a month (flash flood, blizzard warning, tornado warning)
   - Looking to better understand how public responds to our alerts over time; will revise as needed (MG)

- We are info-centric – want to ensure everyone gets the info; pretty stagnant regarding which tools are used for which events (MG)
- We alert for public- or life-safety consequences, imminent threats: "hurricanes sell here," flooding, snowstorms, wildfires, hazmat, high security/national significance and major traffic disruptions (e.g., Super Bowl) (FS)
- Promote the alert service with clickable icons and "follow us" requests in alerts and website communications (FS)
- We send alerts two times per month over average, but every other day during hurricane season (FS)
- Transit and major transportation disruptions (probably 50 a day), AMBER, civil emergencies, police incidents after crime; major transportation disruption; hurricane warnings; weather (not often); we would issue more hurricane warnings but there is a lot of buildup in the media already (AC)
- Alert system interfaces with the CAD system – automatically alerts agency officials of incidents relevant to them; we test this morning, afternoon, and evening to ensure automatic dissemination is working (AC)
- Missing child; evacuations (have issued a couple during this fire season); more likely for us to use it during fire season; jurisdictions use system for test exercise (LL)
- Predominantly weather alerts, which we have tried to automate – alert comes right from NWS to the public, we try to avoid being the middleman; we are the middleman for non-weather alerts (JF)
- Fairfax has 2 systems in 1 (RS)
    - 1: Community Emergency Alert Network (CEAN)
        - Residents can sign up multiple devices, choose to receive a variety of alerts like traffic, terrorist, weather, etc.
        - Business can sign up to 5 people – e.g., [one retail] mall has signed up 5 security personnel
    - 2: Emergency Alert Network (EAN) – service to alert county employees; mandate that every county employee has an account (approximately 14,000 employees)
        - Each agency in local government has its own administrative capability; each creates its own groups so it can send messaging to its group
        - Fire and rescue uses it daily to alert chiefs of big fires 24 hours a day (RS)
- Police Department's public affairs office can just alert a particular neighborhood of a home invasion; [one area that] typically floods – has a special River Watch group – used quite a bit last week; use the systems every single day; today sent traffic alerts; more than 100 messages go out, but a lot just to government employees; today, alerted about a big accident on [the] Parkway (RS)
- Weather another big one – last week sent thousands of messages, EOC opening/closing, requests for staffing; during 2009 Inauguration, we sent out 3.5 million pages – used a lot (RS)

5. What methods do you use to issue alerts? How do you decide what to send through each channel?
    - telephone to subscribers

    - KH: see reverse 911 (all subscribed or unsubscribed get calls)
    - LL: cell phone calls to subscribers (couples with reverse 911 service); smartphones have closed-caption messaging being added; video, too
    - RS: yes, as part of EAN & CEAN system (subscribers can list multiple numbers – including pager numbers)
  - email to subscribers
    - MG: yes to public officials (used less often now)
    - FS: yes
    - AC: Email subscribers get most info – this is most common alert medium from minor to severe
    - JF: alert via email but not to subscribers – emails only go to key POCs in the county (with the hope that they will relay them to their particular constituents…sometimes it works, sometimes it doesn't)
    - RS: yes, as part of EAN & CEAN system
  - reverse 911
    - MG: no
    - KH: yes (people less sensitive to calls now)
    - LL: our primary/true alert system, residents automatically a part of this system
  - Twitter
    - MG: still figuring out how to use SM
    - KH: virtually all incidents/low interruption tool
    - FS: once we issue an alert, almost instantly posted to Twitter
    - AC: social media is used for more significant, severe events; If an emergency is big enough, more severe, we will issue alerts through Twitter, Facebook, our website
    - LL: yes
    - JF: yes
    - RS: Yes. If event grows, may put on blog, SM, etc.; use this quite a bit during events – notify about shelters, preparation, issue updates throughout day (along with Facebook, blog)
  - Facebook
    - MG: still figuring out how to use SM
    - KH: virtually all incidents/low interruption tool
    - FS: once we issue an alert, almost instantly posted to Twitter
    - AC: social media is used for more significant, severe events; If an emergency is big enough, more severe, we will issue alerts through Twitter, Facebook, our website
    - LL: yes
    - JF: yes
    - RS: If event grows, may put on blog, SM, etc.; use this quite a bit during events – notify about shelters, preparation, issue updates throughout day (along with Twitter, blog)
  - Website
    - MG: yes

    - KH: virtually all incidents/low interruption tool
    - FS: pools regional joint information center information
    - AC: if an emergency is big enough, more severe, we will issue alerts through Twitter, Facebook, our website
    - LL: yes
    - JF: yes
    - RS: [blog]
  - EAS
    - MG: yes
    - KH: reserved for most urgent/severe
    - AC: EAS is issued very rarely – haven't issued an EAS message in the last 2.5 years – we rely on NWS for this purpose
    - JF: probably our primary tool along with media; can do local EAS interruptions, but not everyone listens to local radio stations
    - **RS: NWS – if there is something big in [our city] or whole region, use NOAA Weather Radio – can ask them to push out an alert message*
  - outreach to media
    - KH: yes
    - MG: via EAS to broadcasters/private meteorologists; KH: virtually all incidents/low interruption tool
    - LL: yes
    - JF: probably our primary tool along with EAS
    - RS: good relationship with the media; joint information center with 7 staffers stood up when EOC is stood up
  - Other (please describe)
    - MG: communicate via satellite/landline to government officials, state and local EMs to disseminate info
    - Sirens
      - KH: reserved for most urgent/severe (highly disturbing)
      - JF: have a countywide siren network but cannot geotarget it, would take significant money to upgrade
    - [WEA]
      - KH: reserved for most urgent/severe (lack of geo-t, highly disturbing)
    - Weather radio (technically this is part of EAS)
      - KH: reserved for most urgent/severe (lack of geo-t, highly disturbing)
      - JF: "Alert FM" through FM radio (As alert FM grows, we can geotarget better – but still that's hit or miss, if you don't have an FM Alert unit, you don't get the message)
      - **RS: NWS – if there is something big in [our city] or whole region use NOAA Weather Radio – can ask them to push out an alert message*
    - SMS Text
      - KH: reserved for most urgent/severe (lack of geo-t, highly disturbing)

        - FS: reserve for only imminent threats
    - Other Radio
        - RS: XM Radio partnership – LED screen crawl message on the local XM radio channel
    - Blog
        - RS: Yes. If event grows, may put on blog, SM, etc.; use this quite a bit during events – notify about shelters, preparation, issue updates throughout day (along with Facebook, Twitter)
    - DOT
        - RS: Public affairs folks record message on hard radio – [the] DOT will post on electronic highway signs "switch to channel x to hear an important message"
    - TV Crawl
        - RS: TV Channel 16

Additional notes:

- MG: we are consistent in tools we use
- KH: we have found public expects us to alert through certain tools – e.g., phone calls
- FS: alert via a regional interoperability office, use a template that includes content of message and where to point the public (e.g., National Weather Service, Hazmat hotline) for additional information because we don't own 90% of the information shared during an event (e.g., weather, traffic, schools, utilities information/status)
- FS: we have two lists of subscribers and we send alerts to one or the other, or both, depending on the incident: public, media
- AC: different thresholds for alerting, really just is intuitive of what we think will benefit the public; also depends on time of day of an incident: if it's 2 AM and less serious threat, send an email to minimize disruption, but probably follow up with a voicemail alert later in the morning
- AC: Subscribers sign up based on zip code and are also placed automatically into a particular city; subscribers are able to choose the alert type that they want – transit, emergency, AMBER, etc.; we are also working on a time window, so if they only want 7am to 7pm to be alerted, that's the only time they'd receive alert messages
- AC: we don't like to go above 157 characters and we try to use text only when necessary
- LL: right now languages are just through voice, text, email, video, closed captioning, sign language, and Braille readers; looking to expand languages
- LL: In alert, direct public to call 211 to get more information, to find shelters, etc.
- JF: We have many gaps; reaching transients/visitors is our biggest issue
- JF: Don't do reverse 911, landlines going by the wayside
- JF: I'd really like to streamline our system while maintaining its integrity, afraid too many people will have access to these alerts and warnings dissemination points; we'll have an event and they'll use it incorrectly, turn off the public, and then they stop wanting the alerts, turning off the devices (e.g., turning off their radio); trust really has to be there, has to be well controlled
- JF: My jurisdiction is developing a citizens' mobile app that is two-way – app users can get NWS warnings from us but they'll also have access to mapping – they can see

if/where we open shelter; plus, if they see strange weather formations, for example, they can send it to us, and it will automatically be mapped within seconds for our responders; we will do it on an unofficial basis to start; we've done virtual cities – watch storms come in radar-wise and then see 911 calls pop up in that area; with citizen reports, we'll know where to deploy resources, it will help us to prioritize

  - Catalyst: need to be able to obtain immediate information from the public to create an overall picture – we are using a grant, working to build the app with SPAWAR & SAIC

- RS: EAN & CEAN are go-to on daily basis – weather, traffic, basic (communicates via pager, email, cell phones, etc. – multiple devices can be listed by subscriber)
- RS: For a weather watch – we send via email; for a weather warning – send via email and pagers, phones, etc.
- RS: The Region obtained UASI grant funds around 2001 – procured a system called Roam Secure Alert Network; all jurisdictions in [the region] have capability to send alerts using this program; system is very functional, each locality can test, can customize the system to meet their needs; only 75,000 subscribers
- RS: "Geofeedia" – geo-based system we use if we have a special event/area – e.g., can highlight a whole campus and show us every single person sending tweets, using Instagram, etc. if their phones are enabled for location capability – we can see their pictures, tweets and their x and y coordinates; we even will interface with folks – message with those in the map
- RS: If there is an EOC activation, we use everything to alert the public, will use YouTube to post quick video updates; stand up a joint information center with staff of 7 to communicate with media

6. Do you have to coordinate with other organizations to issue an alert? Are there any problems in coordination?
   - We alert on behalf of other organizations like police or fire (KH)
   - No real coordination issues – we train them and then they call us when they need to alert (KH)
   - Sometimes need to coordinate with multiple EMs in a single area (MG)
   - Conduct a lot of pre-event coordination – outreach with EMs, the public, broadcasters, SKYWarn training sessions for volunteers (MG)
   - Real-time chat with EMs, government officials, broadcasters to obtain ground truth (MG)
   - Coordinate with other groups like Army Corps of Engineers etc. depending on type of alert to be issued (MG)
   - Challenge: very small local staffs to coordinate with all these groups (MG)
   - Usually no, but for weather-related incidents we have a great relationship with NWS, they supplement what we do; regarding [WEA] our agency has a clear understanding of what triggers an NWS [WEA] alert and the language they use; in future, when imminent threat weather event doesn't meet NWS trigger criteria, we have agreed that we will issue the weather alert instead (FS)

- Some regional joint information center coordination is required; it is important to be transparent with a common operating picture because it all ties to a larger regional response (FS)
- Some agencies in the jurisdiction have their own public information authorities; there is a lot of coordination if some of these particular agencies are responding to an incident—in which case we service as “trusted disseminator” on their behalf (FS)
- We operate according to the “three Cs”: coordination, collaboration, and communication drives the model of how we do business on emergency management side of things; we have yet to read an after action report that doesn’t prescribe improving communication (FS)
- We are moving from a model of need to know to need to share (FS)
- Technically we have capability to issue without consulting any other organization; don’t want to duplicate weather alerts, so we first see what NWS is doing before we issue a message, generally leave weather to NWS (AC)
- No coordination issues; jurisdictions in county able to issue alerts themselves unless they need help from us; if we evacuate we coordinate with sheriff’s department, but this doesn’t require an approval to actually issue the alert (LL)
- NWS sends their own weather alerts here, but don’t tell us they’ll do it – that is one issue we have! (LL)
- For local alerts, it’s just us sending the alert; we had a local group also alerting…they had access code and put out an inconsistent message and it confused people; if it’s an international alert, we go back and forth to make sure everyone is consistent in messaging (JF)
- The more we can fine-tune our alerts geographically, the better (JF)
- If it’s a generic message to all county residents and is not for a life-threatening event, we’ll coordinate with public affairs on wording; for something like a tornado; we don’t coordinate, just send the message out ASAP (RS)
- For the Northeast Shake Rattle & Roll Event – coordinated messages with the office of public affairs 2 weeks before sending them; we have weather templates, county & school closing templates – just need to insert date and time and then send the message (RS)
- NWS just started a new program – 3 meteorologists work directly with local emergency managers; we [regional authorities, sometimes the state too] will have a conference call with NWS and say “what’s the weather look like?” and then we push out alerts as needed; the NWS group is being proactive – they now will message the NCS with the best & worst case scenarios and what is actually expected – all provided on 1 slide – NWS started this only within last couple months (RS)
- We don’t coordinate messages with NWS, haven’t sent conflicting messages yet; Virginia DOT has an on-site meteorologist (RS)
- Police department has access to send out alerts for law enforcement events because they need to alert the general public (RS)

7. What criteria do you use to decide to issue an alert?
   - We determined nine (9) sets of criteria for issuing [WEA] alerts (MG)

- We have a specific set of criteria for each event type and alerting tool – we try to be very consistent in how we alert so public knows what to expect (MG)
- Only criteria: imminent threat to life and safety; we do not publicize a particular list of events/tools that we'll use – too limiting, will cause us to freeze if something new/unexpected occurs and doesn't align with our protocols (KH)
- Public safety or life safety impact; what is inconvenient for 80% of county could be life-saving for other 20% – and in that case, we will issue an alert (FS)
- We must trust agencies and local jurisdictions on whose behalf we issue alerts; because they think something is lifesaving, we take it seriously and issue the alert (FS)
- Our threshold is dependent on how many people it will affect; if we feel it will effect so many people, then it's necessary to email; different agencies have different criteria, for example transit issues alerts for every little thing – bus detour, escalator outage, etc. (AC)
- Cannot provide specific criteria, it's simply incident specific; if we can put information out though SM and update website if there's fire in your area, then we will (LL)
- Try to use alert system for high level emergencies, e.g., evacuation or shelter in place action (LL)
- Life-threatening, urgency; we wouldn't activate our system for something less severe (e.g., boil water) (JF)
- Traffic – subscriber determined; Terrorist – send to all users; Policies in place based on weather events (RS):
    - for watch only will send to a group within the system signed up to receive those alerts types of alerts, and within the time frame dictated by subscriber (e.g., 9–5, 24 hours) if warning, like severe thunder –
    - for a tornado – send to all users across county
    - Traffic – subscriber determined
    - Terrorist – send to all users (RS)

8. How often do you have to revise or amend an alert (other than an "all clear" notification)? Are the updates always sent via the same channels as the initial alert? What guidelines or criteria do you use for updating alerts?
    - Infrequent changes – if protective action changes, impact area changes, or there's an escalation, we'll revise alert, may add additional tools to issue the revised alert (KH)
    - Update content, cancel, expire, expansion of warning area, new information that is significant and important to people affected; it's important to reiterate that many times; most times – NWS doesn't use the exact same channel or method to disseminate the updates as was applied to alert (MG)
    - Cannot cancel [WEA] alerts (may cancel alert in all areas instead of the limited area that needs to be canceled), block updates from going through [WEA] (90 characters doesn't allow for it) (MG)
    - Depends on incident; if we alert about a storm that doesn't materialize, we send out messages in consumer-friendly terms – here's what's happening, here's a link if you want more information (FS)

- Need to keep coastal weather threats on people's radar with steady flow of messages until official close-out message at end of event (FS)
- We must be particularly careful for unfamiliar/uncommon incidents, in such cases we issue a more steady flow of messages, ongoing alerting effort, exhaustive messaging to keep public engaged (explanation of situation, updates, actions, latest outlook, etc.) (FS)
- Updates always sent on same channels as the initial alert (FS)
- Rarely – don't recall ever amending an alert; if a revision/amendment is sent, it would be sent via same channel used for initial alert (AC)
- Most of our updates are related to evacuation notices; only amendment would be adding to area of evacuation; send updates via the same channel as initial alert (LL)
- Regarding weather, we don't issue "all clears" (JF)
- Normally the message goes out just once, unless the event changes, is extended, grows; we'll likely tell the media to relay additional information and are less likely to go through all the alert channels, especially. If it's just an inconvenience event, rather than an imminent threat (JF)
- No written criteria for our agency; especially on the international side along the water; every situation is unique, wind direction, etc. can all have an effect – we make alert decisions based on each event (JF)
- We send updates via the same channels; only "all clear" is if we have a police event in a specific neighborhood – that's just once every few months (RS)
- Weather – never unless forecast changes; for a severe traffic event – send out 3 – the initial, the update approximately 15 minutes later if a 1–2 hour closure, and the resolution; public does say we send too many messages, but we don't care – you'd can't be perfect with this (RS)

9. Do you have any issues with the propagation of your alerts?
   - Geotargeting is the #1 issue – causes tremendous overreach (MG)
   - Tool's ability to geotarget plays into our use of it; cell phones, emails, social media all disseminate quickly; we can only geotarget with landlines and sirens…but landlines are weakest link in system (KH)
   - No, we have built trust with the public; we also recognize civic groups, etc. can carry more weight than we can; we tell our partners, liaisons, nonprofits to feel free to re-disseminate our information to their constituents; their propagation goes further than we could do ourselves (FS)
   - I'd send more alerts, but it's up to the bosses, who aren't in favor of sending such [storm watch] alerts; I don't know why more alerts aren't sent (AC)
   - I don't think politics is an issue down here; when I worked in NYC – absolutely had issues; couldn't believe what we would alert for; we had 5 staffers dedicated to sending alerts –sometimes we just seemed to alert as a way of demonstrating they were earning their salaries (AC)
   - No propagation issues (LL)
   - No propagation issues; It's frustrating that it takes a period of time to alert via 6 different mediums (JF)

- 7–8 years ago there were many issues but they are now all pretty much addressed; an issue crept up last week related to text alerting – public hasn’t stopped getting text alerts; Cooper sends these alerts as email that is then converted to text for delivery by the carrier/CMSP; the carriers/CMSPs are losing money on this, we think the CMSPs want people to buy text or data plan and for those with neither, CMSPs are starting to bill the customer; what folks don’t realize is Cooper pays a premium to the CMSPs to make sure they push out text alerts in bulk to the public and CMSPs don’t interpret the alerts as spam (RS)
- There is a small number of subscribers, target audience is very small, don’t know if they get the messages, don’t typically ask recipients to respond (RS)

10. Would you please describe your process for changing how you issue alerts? What factors do you consider when making a change to your alert process?
    - We gather feedback informally, discuss what happened after each event informally – feedback is huge regarding how we use the system, construct messages (KH)
    - We have a very complex alerting system, desire to be consistent in how we alert; use formal process to implement any changes suggested via the service assessments, involves experimental phase, etc. (MG)
    - What’s changed more than anything else is all the new channels; SM is the biggest change, [WEA] and IPAWS will be another (FS)
    - SM reaching a different customer, so we are learning to think in terms of 140 characters
    - We now have a template, we create the message in format of the primary alert medium selected for an incident, below that we have a space for creating the Facebook language, below that language for Twitter; this gives the incident commander ability to see all the messages going through multiple mediums will be consistent in tone and fact and he can approve them altogether, extract just the essential elements for the shorter messages (FS)
    - In terms of level of permission to send out, that won’t change; goes from initiator to supervisor, chain of command, to Deputy Director of EM or Director of EM; then after these approvals the message is sent out; messages are always tweaked by the reviewers; review happens pretty quickly though, but in the middle of night things take longer (AC)
    - If an alert is automatically sent by the fire department, that agency has permission to issue alerts for events – say, a two-alarm fire, so approval is complete within a couple minutes (AC)
    - Next month we and sheriff’s department will be on a single system that can alert both land lines (reverse 911) and cell phone subscribers; we will have to make decisions about incorporating all the numbers (LL)
    - We’ll have more accessible formats – some decision making here; goes over to another party to redo message in other format and then message is sent out in the accessible format; no overall changes to process or how we issue alerts – all just based on timing (LL)
    - Really haven’t changed; we are so far behind where we’d like to be, I’m going to be relying on [WEA] to fill the void for imminent life safety threats (JF)
    - Still exploring mechanisms to geotarget – hoping to polygon geotargeting of our sirens; we are quite a ways away from getting down to alerting specifically by blocks or sub-communities (JF)

- For weather stuff, formats, etc. we maintain those; may adjust formats slightly, our templates haven't changed in years; there are minor policy changes due to feedback from the public, county employees (RS)

11. Regarding the content of an alert, what makes it effective? What makes it ineffective? How do you determine the effectiveness of your alerts?
    - Relevance of the current alert, history of relevance with previous alerts (MG)
    - Relevant targeting of a message, clarity of message, tell people exactly what the incident is and what to do about it, consistency of messages on all devices/tools used to disseminate (KH)
    - Follow Dennis Mileti's template for the most part: message label, headline, issuing agency (multiple partners with same message enhances trust), recommended action, consequences of not taking action, who should and who shouldn't act, time to act, then summary and closing, where to go for more information (FS)
    - No good way to determine effectiveness of alert – we just rely on hearing from one person or another that "this alert made a difference in my life"; our alerts just state the facts – blunt, to the point, issuing only when you feel it is pertinent (AC)
    - Alerts should be quick, to the point, directive in nature; too much information or providing opportunity for public to make own decisions is bad (LL)
    - We have internal discussions to determine alerts' efficacy; if SM is saying our alert doesn't make sense, then we'd take a look at it from that perspective, too (LL)
    - Try to put out alerts for life threats…weather events like severe, thunder, tornado, flash flood; we don't put out weather warnings; we alert only for imminent immediate threats because we want public to understand that getting an alert means they should take action, want people to get into this mindset; when siren sounds, you need to take protective action, go inside (JF)
    - Weather event templates were created years back in cooperation with public affairs (OPA) – helped with phrasing of messages – relied on them; created common message format used on everything across the county – "one message, many voices" (RS)
    - For county employee messaging – the OPA may help us craft messages, we are always looking to simplify language, ease understanding; Derecho messaging was clear, beneficial according to public response (RS)
12. What causes the public to ignore an alert?
    - Alert is not relevant (KH)
    - Alert isn't relevant to one's particular area – too much info to too large an area (MG) – not all members of public perceive a message's relevance in the same way (incident that is one mile from me is relevant to some, irrelevant to others) (MG)
    - Over-alerting, not having thresholds for alerting (FS)
    - Won't lose trust if an incident/threat doesn't come to bear, if forecast didn't verify that's a good thing, tell the public what happened and why (FS)
    - If you don't close out an incident, you lose trust (FS)
    - If alert is wrong, don't think people will not react to future alerts, or they'll just react differently (e.g., may ignore next alert) (FS)

- Basic nature is that people will diminish the potential that they will suffer consequence of risk, naturally discount themselves as a statistic; we have started to alert early, pushed up alerting time frames, alert as early as possible so public has plenty of time to delay, deny, deliberate response with neighbors, and hopefully then decide to take action before it's too late (FS)
- "Wasted" alerts, e.g., warning of firework noise on July 4, alerting of helicopter activity instead of placing a sign or message board in the actual area of helicopter activity (AC)
- Too many alerts, unclear language, no direction, too vague, unclear who sent the message; public is forgiving if you make a mistake one or two times, but they lose trust if you keep repeating the mistake (LL)
- Overusing the warning system for non-life-threatening situations; we want to warn only of imminent threats to life moving forward (JF)
- Having a warning system that you cannot geotarget so that you must notify an entire county of an incident affecting just 1 or 2 counties (JF)
- Our sirens don't provide public with the mentality that they should go inside due to a chemical spill; they still think sirens are for a tornado…if it's sunny then they'll probably ignore it; public has been programmed over the years that it's a tornado siren – we need to change the culture (JF)
- You evacuate for a weather event, and then the weather changes course; public may think "the last time I left and nothing happened, so I'll ignore it this time" – complacency is a big issue (JF)
- Too many messages is the common theme we hear; very careful to make sure there is added benefit when we send messages out; some subscribers have technical issues; people want more personal information, ignore messages that are too generic – but we have to keep the whole audience in mind; people are angered if a message doesn't make sense (RS)

13. What feedback do you get from issuing alerts, including feedback from the public?
    - Calls and emails; formal service assessments; local office conducts post-event conversations/interviews with community after event (MG)
    - Complaints when something doesn't work – calls didn't go out or took too long; we see lack of understanding by public – very info hungry and want to know about every incident; we have to play big brother and tell them only what we think they need to know (KH)
    - SM has been the single most effective way of determining how public reacts to alerts and if they are even of interest to public; sometimes surprised by what does or doesn't pique public's interest; learn in real time of impact we are having (FS)
    - Even if it's an alert, lifespan is very short on SM; within first 5–10 minutes every single re-tweet has occurred…then the message is dead (FS)
    - Have had incidents in which public could send on the ground information to us faster than first responders on the scene – we take this as validation of our trust relationship with public; it has changed how we must do things; SM information must be pretty accurate, they aren't afraid to correct us (FS)

- Overall Facebook, Twitter feedback is positive; a lot of appreciation of our messaging, shows on Facebook through number of people who share the information, retweet – implies their trust; recognize we also have some disaster junkies who follow us, comment (FS)
- Very little feedback [here] – occasionally see increased number of people signing up, often when we get media publicity; think we get so little feedback because very few people are aware of the service (32,000–35,000 subscribers) (AC)
- Wireless carriers have done fair job, but I'd guess only 2% of the public knows about [WEA] (AC)
- Regarding how to subscriber/opt in to service – some learn about it when they are on the general county website; I don't recall seeing PSAs, bookmarks, handouts; no access to [WEA] promotion funding per my internet search (AC)
- Don't think we receive any; and if/when we do it is negative feedback; we don't hear when an alert has been useful or helpful; usually get any feedback via email (LL)
- Before we adjusted one of our systems, the public was getting winter storm warnings at 4 AM; anyone with TV or radio would know about this anyway [media notifies people of weather events days early], so people started shutting devices off for this; I don't think a winter storm is life threatening; a flash flood that develops quickly – that's the type of warning that has to go out; most don't want to be awakened for a watch or advisory (JF)
- I'm a believer, just from the bit of feedback we've received, in the philosophy of fine turning/ geotargeting alerts down to affected area—this really will give you better public response; if you send an alert to people not affected by an event, you wear on people's patience (JF)
- Don't elicit much (RS)
- There is a cost associated with alerts – every message has a text fee; technical issues are regular due to type of phone, how they sign up; we get a lot of positive feedback (RS)
- Sometimes feedback is that the public didn't get enough messaging, messaging wasn't timely – part of the is reason we don't have 24-hour office – I have to get to computer, log into the VPN, or travel to a computer – it can result in a 30–60 minute delay – we don't have capacity to staff alert center 24 hours/day (RS)

14. Do you collect data on the response to the alerts you issue? What data do you collect and how do you use it?
    - Have a few formal surveys; otherwise all feedback is informal, anecdotal, minimal content (KH)
    - We get feedback from larger scale incidents; but they are very infrequent and each time they occur the system is in a different place – so don't think you can directly correlate – we can detect no real pattern (KH)
    - NWS collects information, passes it on to carriers (MG)
    - Collect statistics on alerts sent, speed, etc.; use service assessments to gather public feedback (MG)
    - Annual survey, questions vary by year (MG)
    - Natural Hazards Center conducts studies (MG)

- Warning Coordination Meteorologists gather regular feedback from EMs, local authorities; note that data is not collected for every single event nor recorded in a single place for all of NWS (MG)
- Haven't collected because it's just context of event or situation, not sure honestly what kind of value the data has; good for us to learn [reference is to SM feedback] what parts of messages people are reading (FS)
- No good way to collect data; through the vendor we can say we initiated and an alert was sent, but can't confirm who in the public actually received the alert, just see vendor has sent it out; so there is little room for any feedback – it lies in hands of the carrier who actually delivered, and we don't have a way to access the information from the carrier (AC)
- I have limited knowledge of SM feedback (if it is collected, recorded), but nothing has risen to the level of saying we're getting so much SM feedback that we have anything major to address; trying to work with a local university to have them be a gateway for us to monitor SM – with all the Crisis Common opportunities, etc. we need someone actually looking at the SM information; public seems to be asking for more clarifying messages rather than saying the system simply doesn't work (LL)
- Survey monkey surveys ask very basic questions; structured more to minimize what we get back, we don't have huge staff to delve into tons of data [see also response to question #1] (RS)

15. Do you receive acknowledgement receipts to alerts you issue? Are the acknowledgement receipts analyzed by you and have they influenced how you issue alerts?
    - Get an "ack" from IPAWS – not influencing current processes, just machine to machine communication (MG)
    - No; we also do not solicit direct feedback of alerts from public, do not have staff to monitor public acks and are concerned they'll communicate through this medium instead of 911 when they are unable to respond to the alert (KH)
    - Can see in real time how many have read it, haven't read it; get an ack from alert system (FS)
    - No (AC)
    - No, we get something from vendor on success rate of issuing messages, but no ack messages from the public (LL)
    - For Alert FM, we only get an "ack" that the message went out; for the emails to POCs, we get some responses to say they appreciate the info, but very little – we aren't really asking for that, probably that's on us (JF)
    - Feedback we've received just strengthens that need to use the SM medium to alert (JF)
    - We have the capability; but we don't use data unless we do reverse 911 type calls – so we know who was home and answered the call, pass on to police department; but we don't do this on a day to day basis (RS)
    - We simply don't go back and look at acks; we have asked in the RFP for more robust capability, function we are asking for in the next system; don't have full time staff, and only have one administrator to make sure the system is working (RS)

16. How do you inform and educate the public regarding your alert system? How has that education affected the public's response to your alerts?
    - All just comes down to ultimately how public responds to alerts; attend public safety fairs, place flyers in libraries, schools, lobbies, police and fire offices; magnets; have a nonprofit partner who conducts outreach – all just basic outreach; no advertising budget (KH)
    - Webinars with Warning Coordination Meteorologists (train the trainer); then then conduct PSAs, workshops, present at schools, speak to EMs, share info on website (MG)
    - NWS headlines [WEA] on its website when time/space permits; conduct seasonal campaigns, promote via mass media (USA Today, Today Show) (MG)
    - Pushing wireless industry to conduct [WEA] outreach (MG)
    - There is synergy between alerts, regional joint information center website, SM, press conferences; Facebook and Twitter icons part of alerts; website popups; promotion language part of alert template; capitalize on these synergies during hurricane season (FS)
    - We really don't inform or educate; we've gone to lengths to get funding from the county to educate the public about our services, but the budget is very tight; every once in a while, if folks are out doing public service or a community event, we'll promote; ask public to opt in during a press event (AC)
    - Almost takes an incident for public to get onboard, to sign up; I've been following this trend for years in every system I've worked – Super Bowl, convention, etc. (AC)
    - We do a number of education activities – promote during actual events (most helpful), reminders on press releases, partner with businesses and nonprofits to do incentivized promotions (car dealerships, Girl Scouts, Papa Johns); media buys; booths at community events, presentations at rotary meetings and local businesses; message is the same: get a plan, know what you need to do, register your phone, get a kit, stay informed (LL)
    - In terms of effect to public response: does well, have 200,000 people opted into alert service; DHS studies and Centers of Excellence have recognized the efficacy of our opt in raters – think we have one of highest rates in the United States (LL)
    - We have a media campaign to encourage people to purchase an Alert FM device; in event of an emergency situation, PSAs, reminders, getting on radio, reassuring and providing additional info via media (JF)
    - I'd turn the question on you – how does any education really work? Some appreciate it, some expect you to be at their door in 5 minutes…would like to think getting feedback from the public is a positive thing. You get a lot of "I saw you on TV or radio the other day" feedback. We know people are hearing it. (JF)
    - In 2007, one question related to public education was a positive rating response regarding our job of educating the public about risks and hazards…we are trying to make people self-sustaining rather than just relying on us (JF)
    - Our attrition rate is low on the subscriber base, which increases approximately 10,000/year – we conduct outreach like crazy to attract subscribers; promote hard radio system; NOAA radio; distributed 650 radios throughout county at an event; share common preparation message, common alerting and communications – have radios, batter-

ies, flashlights; earthquake drill – did messaging for this; tornado drill – provide a full presentation, messaging to all county residents (RS)

- Conduct dedicated individual outreach – any community function, conduct business outreach, tabletops, always use the canned message "make a plan" and include messaging about signing up for CEAN; want them to know the NCR blog is out there, can get info about Fairfax and the NCR; we also use a county blog (RS)
- Regarding [WEA] – I have an article that is almost done – we have working group, YouTube, plan to blog to message and let people know of major carriers participating in [WEA], what message will look like, trying to get the region on board, public affairs to push out messages and let people in region know [WEA] is out there, but must be careful with messaging – only [a few jurisdictions] have it.(RS)

17. What should be done to improve alert systems? What would be the perfect alert system?
    - We need proximity based alerting (MG)
    - Want to see following changes (ranked) (MG):
        a. Improve geotargeting
        b. Proximity based alerts
        c. Graphic of warned area
        d. Embedded link to additional info (graphics, additional detail)
        e. Allowing opt-in/out of Severe and Extreme alerts (note: implementation of carriers is not exactly consistent – e.g., iPhone has all or none for opting in and out)
        f. Increase text length to traditional text messaging limit from 90 characters
        g. Consistent name for service
        h. Remove Confusing Text below WEA Message
        i. WEA service indicator (suggested by FEMA, like wireless emergency alert service indicator so you know if area can actually send a [WEA] alert to you)
    - Huge public expectation management issue (KH)
    - [WEA]: geotargeting and 90-character limitations; also just learning about option to issue free form [WEA] alert messages (KH)
    - Alerts can start to become more effective by personalizing them – alerting on personal devices solves targeting, can overcome translation issue and disabilities (e.g., blind person's or Spanish speaker's devices will display in way that user needs), users can set level of alerts they want to see (though I am not a fan of that – think this should be up to EMs, not public) (KH)
    - Only perfect system would be a chip in the head, driven by satellite, but then you still have single point of failure. There is no one perfect system – you need a layered system and multiple methods because people aren't always doing the same thing, they moving around in the car, home, at work, away from home on vacation in another part of country – all sorts of things you need to communicate information (MG)
    - Need to ensure consistent messaging (MG)
    - A lot of challenges to work on; in a perfect system, you can communicate with all people, channels, times, all hazards (FS)

- Need better integration of all systems, mobile technology (Pandora, apps, additional bandwidth to cover supplemental information) (FS)
- 90-character limit of [WEA] is intimidating; are we doing ourselves a favor or creating a problem by limiting amount of data we can provide? (FS)
- System that compiles data for you, allows public to respond to alerts and ask questions, and is monitored by staff; someone can issue an alert on the fly using an app, able to export data to excel, data can be made as interchangeable as possible (AC)
- Automatic alerts – right now, when a tornado warning is issued, an auto alert is sent out to the public; if automatic, there is less chance of error (AC)
- Whole idea of [WEA] would be perfect with lack of opt-in requirement; ability to alert in multiple languages, get out messages faster, include graphics, etc. in messages (LL)
- Regarding 90-character limit – very low – why not increase when carriers say they can go up to 160? (LL)
- Need nationwide public education and need funding to do it, especially if you have to opt in
- County level geotargeting of [WEA] great if your county is small…but here in California, the counties are much larger whereas east of Mississippi areas are more city-centric (LL)
- There should be one point of distribution to several alert systems with a strong focus on geotargeting (JF)
- Parameters of use are important; you can twist any event to say it is somehow life threatening; several years ago we had a tabletop event in Chicago and talked about H1N1; the health department would send out alerts every hour (JF)
- I have been onboard with [WEA] for years – it's one of the ways to go, will provide great opportunity – would like to see it hit cell phones and email – email would be an opt in piece (RS)
- No cost to citizens (RS)
- Full functionality allowing me to drill down to cell tower and it tells me the exact coverage/true alert area (RS)
- Messages longer than 90 characters – slight increase would be beneficial for [WEA] (RS)
- CMSPs should advertise a lot when you buy a phone; people in this region are already getting [WEA] messages and have no idea what they are – they call us all the time to ask (RS)
- NWS alerts should be automatic – if an event/reading hits certain criteria, an alert should be automatically routed to [WEA] (RS)
- Full mobile capability – if I'm driving down road, I want to pull over and have my i-Phone give me access to send a message with full functionality – this would be huge (RS)
- Geotargeting capability– Google Earth to really drill down (RS)
- All the real numbers within a geographic database – worldwide system (RS)

- Version has an e911 database; but there is so much transition, the list is made outdated daily; unless you get daily update your list is out of date – want this to auto populate into my database – hit cell phones and home phone and provide language translation (RS)
- Closed captioning on phones to alert the hearing impaired – have a special vibration, visuals (RS)
- I'd like to be notified if someone else issues alerts; I want to know (RS)
- Ability to manage through WebEOC software used by NCR (RS)
- Report tracking – find out how many people are actually getting messages, proactive capability, see who has gotten it (RS)

18. Have you consulted with anyone regarding ways to make your alerting system more effective? Who?
    - Looking at Sprint blog – consistent with what we've seen in scientific lit – public wants relevant messages, will disable device if annoyed by messages; communicate with other agencies, vendor, public safety forums, etc. for lessons learned (KH)
    - Working one on one with carriers, ATIS standards organization, FCC (MG)
    - Our vendor, Emergency Management magazine blog, LinkedIn mass notification forum (AC)
    - We've done some public forums to find out what recipients would like to be notified of. Have spoken with POCs that we can alert versus also notifying the public; we've conducted cross border discussions to make that better (JF)
    - Still think there's a huge gap in alerting across America if you are going to do it right. Sure you can send out alerts, but does the public really understand and respond to the current systems? (JF)
    - In response to the RFI this summer – 6 companies showed their products to us – a lot of neat ideas that we incorporated into our proposal request; also reviewed some studies; we plan to conduct site visits to see systems in the region, what they do, and how well users like them; don't want to do this acquisition process again for a long time (RS)
19. How does [WEA] figure into your alert strategy? What do you see as benefits and detractions of using [WEA]?
    - Biggest benefit of [WEA] is that it doesn't require public outreach, subscribers; public knows about system to receive the alert – huge advantage (KH)
    - Can't be used for local incidents – no way to tailor the message for all the people in the huge geographic area being targeted (KH)
    - People respond well to texts – great force multiplier to messages they get via telephone (KH)
    - [WEA] doesn't replace other systems, is part of a larger network (MG)
    - [WEA] will be added to our template, need to integrate into systems/services (FS)
    - Benefit of [WEA] is reaching all our constituents, all our commuters; but in some ways [WEA] is worse than EAS – people aren't accustomed to getting the [WEA] message – until it's an accepted part of how emergency management communications with the public, we must use it judiciously, first few messages will generate heightened sense of interest (FS)
    - Assume we'll be able to alert at cell-tower level eventually (FS)

- Regarding regional alerting, not just within a region now, need to create consistent/uniform alert triggers, formatting style, concept of how we issue alerts, close out alerts – all this must be part of an overall communications strategy to build credit, trust, etc. (FS)
- Thresholds probably higher than EAS for [WEA] until we find a good fit for [WEA], EAS and [WEA] will probably be used for same incidents in future; this is initial approach until public acclimates and we pass learning curve; plan to take a lot of lessons learned from NWS's use of [WEA] (FS)
- [WEA] fits completely into my alerting authority, but we are cautious about when to use it unless it is for a large specific emergency event; obstacle is it can't be issued for small areas; thought of using it for tropical storms, but I want public to know about the service first; if we issue county-wide emergency messages, a [WEA] alert would fit right in (AC)
- [WEA] ability to communicate via cell towers helpful in reaching [tourists], frees us from dependency on subscriptions to send geotargeted alerts…[WEA] is another tool to fit into our service to geotarget – however, [WEA] is county-wide, don't want to alert those two hours away (LL)
- [WEA] is important if used for the right purpose and especially if its messages can be geotargeted; I think [WEA] is invaluable, especially when you get to the point of targeting cell towers – especially when you can contact mobile device users and those passing through your county (JF)
- [WEA] alerts from NWS will be automatic – we'll try to coordinate so we know it went out – but we're still going to duplicate efforts – want to ensure message is the same, haven't sat down to work this process out with NWS yet (RS)
- When sending only to cell phones, the message goes out, is rebroadcast every *x* minutes – you have so much transition, people will drive into an area, get the alert, then leave the area and not know finality, not get an event completion message; not sure they will get messages when traveling through the region in between broadcasts (RS)
- For the NCR, we have people who speak different languages – this is a concern with [WEA] (RS)
- If I send an alert to the area that borders [neighboring counties] – how do I deal with this bleedover? How do I coordinate? Every jurisdiction wants to send its own messages – don't expect a single entity will be accepted as messaging on behalf of the whole county – never (RS)
- Don't know which CMSPs can geotarget down to cell tower level (RS)
- Regarding the character limit, planning to create templates in advance to fill in the blank (RS)
- Can only issue [WEA] alerts from one location, the EM net desktop PC in our office – so I must be in that room to send it; Web EOC is working on this issue along with Cooper to provide more flexibility so we can just log into the system from home (RS)
- [WEA] is very beneficial but we have to be even more careful of crying wolf and people opting out – then we'll lose our big audience (RS)

- On Monday, 11/5 call with SRA [on behalf of SEI's [WEA] Systems Integration Project] – mentioned I want to connect with the CMSPs and find out what geotargeting capabilities they have, which phones are [WEA] capable – but they are squeamish, don't want to tell us about their capabilities (RS)

20. Please describe any experience you've had with [WEA]? How has that worked? Was it effective?
    - [WEA] alerts are delivered quickly, feedback is good in larger cities, poorer in rural areas (MG)
    - Grappling with need to test system – more important to AO than public – but you can overtest (MG)
    - We don't use [WEA] – targets too large an area and can't tailor messages; even EAS provides us more flexibility of messages compared to [WEA] (KH)
    - Huge disconnect by FEMA in not telling people about option to issue free form alerts (KH)
    - Have yet to use [WEA], determining best way to use it and erring on the side of caution; system is ready here, once I use it for a live event, I won't need to participate in S&T's testing [note: that Miami–Dade is on the list of alert originators who have agreed to participate in the first regional test being conducted by DHS/SEI/SRA] (AC)
    - [We have] permission from FEMA to issue free-form [WEA] alert messages, short code; do not have to rely on CAP-extracted elements to issue a [WEA] alert (AC)
    - We haven't used it; all experience is from NWS sending messages and our playing catch up, responding to media, people asking us why they are getting evacuation notices when it is sunny in their part of the county; experience has been negative so far because our experience has been reactionary, we are worried about the public already opting out due to the issues with NWS messages in this area (LL)
    - We've done all we needed to adopt so far, filled out paperwork, tested with Sprint, etc. but our vendor is not able to send [WEA] alerts yet; that said, not sure we'd use [WEA] based on only being able to alert using county FIPS codes – there's nothing we can send out that would be a county-wide message (LL)
    - Haven't used [WEA] – that's the frustrating part [waiting for first Regional Test] (JF)
    - Like that you have to opt out not in, think that's huge; if abused, you'll get a lot of opt-outs though (JF)
    - Regarding plans for [WEA] use – we'll try to be consistent with Alert FM as far as weather is concerned; not sure if NWS will have access or perhaps we'll be able to capture their messages; use for evacuations, in-place sheltering (JF)
    - Hoping there will be some policy for weather use; would hate to see system abused on important but not life-threatening situations (JF)
    - [DHS staff] visited the [regional authorities] several months back; I went to Las Vegas in February to present on [our] ideas; worked with my state representative to get all this [WEA] adoption work done; already received a COG, etc.; the state is having issues because they have a committee that wants us to send EAS alerts along with [WEA] alerts – state isn't going to tell us what to do (RS)
    - I've taken the FEMA IPAWS course online (RS)

- Waiting for Web EOC and Cooper to come up with their hook, planning conversations with fire and police on best ways to use [WEA] (RS)
- I know of discussions of version 3 and next generation – I'd love to see the federal partners put together a big campaign for [WEA] (RS)

Additional Questions:

- Are there any factors we've missed that you believe influence the public's trust in alerts?
  - Lack of trust in system doesn't preclude me from using system, important to work closely with vendor to get your system right (KH)
  - Even if system works perfectly, you still need public trust – if people don't understand your procedures, don't trust your agency, your system will be ineffective – and unfortunately you can't reach your entire constituency to communicate all this information to them (KH)
  - Outreach is incredibly important – public should know whom to contact with a problem (MG)
  - Carriers still have a lot of work to do, still sending callers back to us with questions (MG)
  - Building expectations with the public and living up to them is key – requires a ton of communication with public throughout process (MG)
  - We need to factor into trust model how to communicate a mea culpa to public – know there will be some mistake, some erroneous message that goes out – how should AOs handle that? (MG)
  - Alerts should be issued to the most precise area possible and understand exactly who will get that alert (MG)
  - Must ensure 911 is at the table when making alerting decisions, keep 911 in the loop when alerts go out; recognize difficulty of this because 911 is slotted within different parts of public alerting (EMAs, local law enforcement…so easy to think someone else is in communication with them, and ultimately they are left out) if they aren't in the loop and members of the public call 911 about an alert, they will have less trust in the alert: "if 911 doesn't know about it, how can we believe it?" (LF)
  - You are stumbling on concept of trust – singular variable – hunch that what you're after is a little more complex; AO trust in [WEA] is separate and distinct from public response to alerts (DM)
  - I don't think [AOs] assess [public trust], try to predict it, or even think about that (DM)
  - Scientific literature about public response has an incredibly detailed synthesis about factors that bear weight on trust – independent variables – trust is just one of a dozen you must take into account to figure out public response; you can't predict response from just the variable of trust (DM)
  - I'll bet there are people in the country freaked out by CAP, IPAWS and [WEA] – and all the proposals, money, etc. they need to expend to get up and running with [WEA] – think it might be useful to measure some control on it – originator's response to adopting [WEA] (cost, intimidation of process), to the system itself must be assessed and factored in somehow (DM)

  - without doing a national education campaign to at least the big cities about the program, its guiding principles, etc., [WEA] won't be very effective…at least until a disaster occurs and people learn more about it; most counties depending on state to educate, state on Feds to do it…or carriers or other system owners; forget the emails – spend 44 cents and send a hard letter to every county EMA director or manager (AC)
  - The word isn't getting out – people don't have time or expertise to do the paperwork; if FEMA would provide someone from each region as an asset to the states in all 10 regions, you'd have way more people signed up for [WEA] (AC)
- Are there any factors that influence your use of an alert system, either positive or negative, that we have not covered?
  - Who owns education? Who is responsible? Train has left the left station, public has no idea what we are doing re: [WEA] (LL)
  - We are a border county – messages have potential [bleedover] to cross not only a county or state line but international boundaries (LL)
- Would you be willing to discuss this topic further with us? We would like to get more in-depth information about your experiences.
  - DM: Yes, prefer calls over document reviews
  - MG: Yes
  - KH: Yes through end of 2012; KH to provide new POC
  - LF: Yes, but probably not best resources; LF to provide new POCs
  - FS: Yes
  - AC: Yes
  - LL: Yes
  - JF: Yes
  - RS: Yes

Appendix C Original List of Factors Considered for Public Trust Model

Proposed Public Trust Measures for the WEA Trust Model

1. Relevance of alerts
2. Public interest in subscribing to alerts
3. Promotion of the alert system to the public
4. Opt-out rates
5. Criteria for issuing alerts
6. Criteria for amending alerts
7. Frequency of alerts
8. Issuing a final communication
9. Disconnect between public versus official’s use of alert system
10. Alerts that communicate action to take
11. Alert originator direct engagement with public in advance of issuing alerts
12. Use of a public notification office
13. Translation of alert into multiple languages
14. Public control over the rendering of alerts on their devices
15. Easy public “follow us” mechanisms
16. Types of threats in alert system
17. Public selection of type of alert to follow
18. Public selection of time window to receive alerts
19. Brevity of message so public can read quickly
20. History of relevance
21. Clarity of message
22. Consequence of no action
23. Who should vs. should not act
24. Time window to act
25. Summary and closing
26. Venue to seek more information
27. Provision of instructions (the public need not make guesses)
28. Public perception of relevance
29. Over alerting
30. Messages that tell public what happened and why
31. Psychology to underestimate threats and overestimate benefits
32. Lead time provided by alert
33. Degree of wasted alerts

34. Repeated violations of trust that cause cumulative damage
35. Public perception of info withheld
36. Public use of communication mechanisms to share real-time info
37. Degree to which public overtly corrects alert originators
38. Degree to which public shares or retweets information
39. Ability for public to request clarifying information
40. Degree to which the alert is personalized
41. Customization by location, time, type of alert
42. Degree to which the public can provide feedback and feel heard
43. Public perception of government
44. Degree of redundancy of alerting
45. Public location to charge device versus location for which public wants to be notified
46. Degree to which transients and visitors are handled in a given area
47. Degree to which public can interact with alert system
48. Degree to which alerts are viewed as spam
49. Degree to which alerts do not address imminent life-threatening situations
50. Degree to which alert does not make sense
51. Degree to which 24-hour coverage is provided by alert system
52. Degree of outreach, giveaways, TV presence
53. Degree system is promoted at time of sale of cell phone
54. Closed captioning and special vibration
55. Degree to which different local jurisdictions handle alerts in uncoordinated fashion
56. Imminence of threat

Appendix D Public Trust Model Factor Descriptions

Factor	Description
1_Relevance	Applicability of the alert to the receiver. Does it affect the receiver's current location? Is it received at the appropriate time? …
10_Action to take	A definitive statement of action to be taken
100_Believing	Recipient accepts the alert as true
101_Hearing	Recipient receives and reads the alert
103_Acting	Recipient takes action stated in the alert
103_Understanding	Recipient comprehends the information provided in the alert
12_Alert source	The governmental tier of the sender (i.e., local, county, state, federal)
15_Easy additional follow-us mechanisms	Ease of obtaining additional information from the sender via other communications channels
20_History of relevance	The applicability of previously received alerts to the recipient
21_Clarity of message spelling and grammar	The degree of grammar and spelling errors in the alert
23_Who should act	A definitive statement of which recipients should take the actions stated in the alert
24_Time window to act	A definitive statement of when the recipient should take the actions stated in the alert
26_Where to go for more information	A definitive statement of places to seek additional information regarding the event precipitating the alert
3_Public awareness of WEA	Public knowledge of WEA prior to issuance of an alert, developed through outreach via media channels (TV news reports, radio news reports, newspaper stories)
30_Explain what has happened	A definitive statement of the event that has precipitated the alert
32_Lead time provided	The amount of time between the issuance of the alert and the moment when action must be taken
33_Degree of wasted alerts	
37_Confirmation via social media	Information contained in the alert is disseminated by others through social media networks such as Facebook and Twitter
4_Opt-out rate	The percentage of alert receivers who choose to disable the receipt of future alerts
44_Redundancy of alerting	Information contained in the alert is also available through other channels such as TV and radio news
48_Alerts viewed as spam	Alerts are pre-judged as spam
55_Local jurisdictions act uncoordinated	The level of cooperation between senders within a region, as evidenced by avoidance of redundant alerting, agreement between alerts, etc.
7_Frequency	The time rate at which alerts are received (e.g., alerts/month)
70_Explain why I should act	Provides a justification for the action stated in the alert
71_Message in primary language	Alert is provided in the primary language of the receiver
8_History of final communication	Issuance of a final communication (e.g., all-clear notice) at the end of the event
99_Type of alert	Presidential, Imminent Threat, or AMBER

Appendix E Alert Originator Trust Model Factor Descriptions

Factor	Definition
Appropriateness	The degree to which WEA provides an alerting solution that is appropriate to the event
Authority	Permission and prerogative of the AO to issue the alert
Certainty	The verifiability of the associated event is sufficient to justify a WEA message
Geographic breadth	The size and location of the geographic region impacted by the emergency event is consistent with WEA capabilities
Responsibility	The AO's obligation and authority to issue the alert (i.e., is it clear that the responsibility and authority to issue the alert resides with the AO, or could some other organizations be responsible for issuing the alert?)
Severity	The degree of impact associated with an event is consistent with WEA usage
Time of day	The time of day (e.g., waking hours, middle of the night) when the alert is to be issued
Urgency	The degree of immediacy associated with an event is consistent with WEA usage
Availability	The degree to which the WEA system is capable of being used when needed to issue an alert
Security	The degree of confidence that the WEA service is robust against attempted cyber attacks (e.g., spoofing, tampering, and denial-of-service attacks).
System accessibility	The ability of AOs to gain access and admittance to the WEA service when and where desired
Remote/portable access	The ability of AOs to generate WEA messages from remote locations
System ease of use	The facility (or difficulty) with which AOs may use the WEA service to issue alerts
Cross-system integration	The ability of the WEA service to work in conjunction with other emergency management systems
Magnitude of effort	The amount of time and work needed to issue the alert
Templates	The availability of predefined formats and information to accelerate and ease the process of alert issuance
System readiness	The degree to which the WEA service is operable and ready for use when needed
System reliability	The degree to which AOs may depend on the WEA system to operate correctly when needed
Training	Creation of skills, competencies, and knowledge for AOs
Practice	The exercising of skills needed to operate the WEA service effectively
Skills/competencies	The aptitude and capability to operate the WEA service effectively
Understanding	The knowledge of the operational characteristics of the WEA service
Effectiveness	The degree to which the WEA service accomplishes its intended purpose
Accuracy	The ability of the WEA system to disseminate correct alert information to intended recipients
Location accuracy	The ability of the WEA service to disseminate alerts to the defined locations
Message accuracy	The ability of the WEA service to disseminate alerts with the message content intended by the AO
After-action review data	Knowledge resulting from in-house review and analysis of prior WEA message disseminations

Factor	Definition
Alert frequency	The number of WEA messages issued within an area in the immediate past
Message understandability	The ability to convey necessary information within the constraints of the WEA message
Public awareness/outreach	The establishment of prior awareness and public education regarding WEA services
Public feedback history	Information received from the public regarding prior WEA messages (e.g., “thanks for warning me,” “don’t wake me at night”)
System feedback	The quality and value of information describing system function that is provided by the WEA service to the AO
Historical system feedback	Information from the WEA service regarding prior performance (e.g., dissemination time, alert geolocation data)
Real-time system feedback	Information from the WEA service reporting the status of the current WEA message dissemination process (e.g., message delivered, message rejected)
Timeliness	The ability of the WEA service to disseminate a WEA message within a suitable time frame

Appendix F Relationships Among Public Trust Model Factors

Factor / Hierarchy

- 103_Acting
  - 10_Action to take
  - 24_Time window to act
  - 32_Lead time provided
  - 23_Who should act
  - 1_Relevance
    - 30_Explain what has happened
    - 70_Why I should act
    - 23_Who should act
  - 100_Believing
    - 30_Explain what has happened
    - 70_Explain why I should act
    - 44_Redundancy of alerting
    - 33_Degree of wasted alerts
    - 20_History of relevance
    - 1_Relevance
      - 30_Explain what has happened
      - 70_Explain why I should act
      - 23_Who should act
    - 55_Local jurisdictions act uncoordinated
    - 3_Public awareness of WEA
    - 8_History of final communication
    - 12_Alert source
    - 7_Frequency
    - 21_Clarity of message spelling and grammar
    - 37_Confirmation via social media
      - 55_Local jurisdictions act uncoordinated
    - 26_Where to go for more information
    - 103_Understanding
      - 55_Local jurisdictions act uncoordinated
      - 21_Clarity of message spelling and grammar
      - 71_Message in primary language
      - 15_Easy additional follow-us mechanisms
      - 101_Hearing
        - 4_Opt-out rate
          - 55_Local jurisdictions act uncoordinated
          - 44_Redundancy of alerting
          - 48_Alerts viewed as spam
            - 99_Type of alert
            - 7_Frequency
            - 3_Public awareness of WEA
            - 20_History of relevance
            - 1_Relevance
              - 30_Explain what has happened
              - 70_Explain why I should act
              - 23_Who should act
            - 21_Clarity of message spelling and grammar
            - 44_Redundancy of alerting
            - 33_Degree of wasted alerts
        - 48_ Alerts viewed as spam
          - 99_Type of alert

7_Frequency
3_Public awareness of WEA
20_History of relevance
1_Relevance
- 30_Explain what has happened
- 70_Explain why I should act
- 23_Who should act

21_Clarity of message spelling and grammar
44_Redundancy of alerting
33_Degree of wasted alerts

Appendix G Relationships Among Alert Originator Trust Model Factors

Factor / Hierarchy

- WEA utilization
  - Appropriateness
    - Urgency
    - Severity
    - Certainty
    - Geographic breadth
    - Time of day
    - Consequences
    - Responsibility
    - Authority
  - Availability
    - System readiness
    - System accessibility
      - Remote/portable access
    - System reliability
    - System ease of use
      - Magnitude of effort
      - Cross-system integration
      - Templates
    - Training
      - Skills/competencies
      - Understanding
      - Practice
    - Security
  - Effectiveness
    - System feedback
      - Real-time system feedback
      - Historical system feedback
    - Public feedback history
    - After-action review data
    - Timeliness of dissemination
    - Message understandability
    - Accuracy
      - Message accuracy
      - Location accuracy
    - Public awareness/outreach
    - Alert frequency

Appendix H Public Trust Model

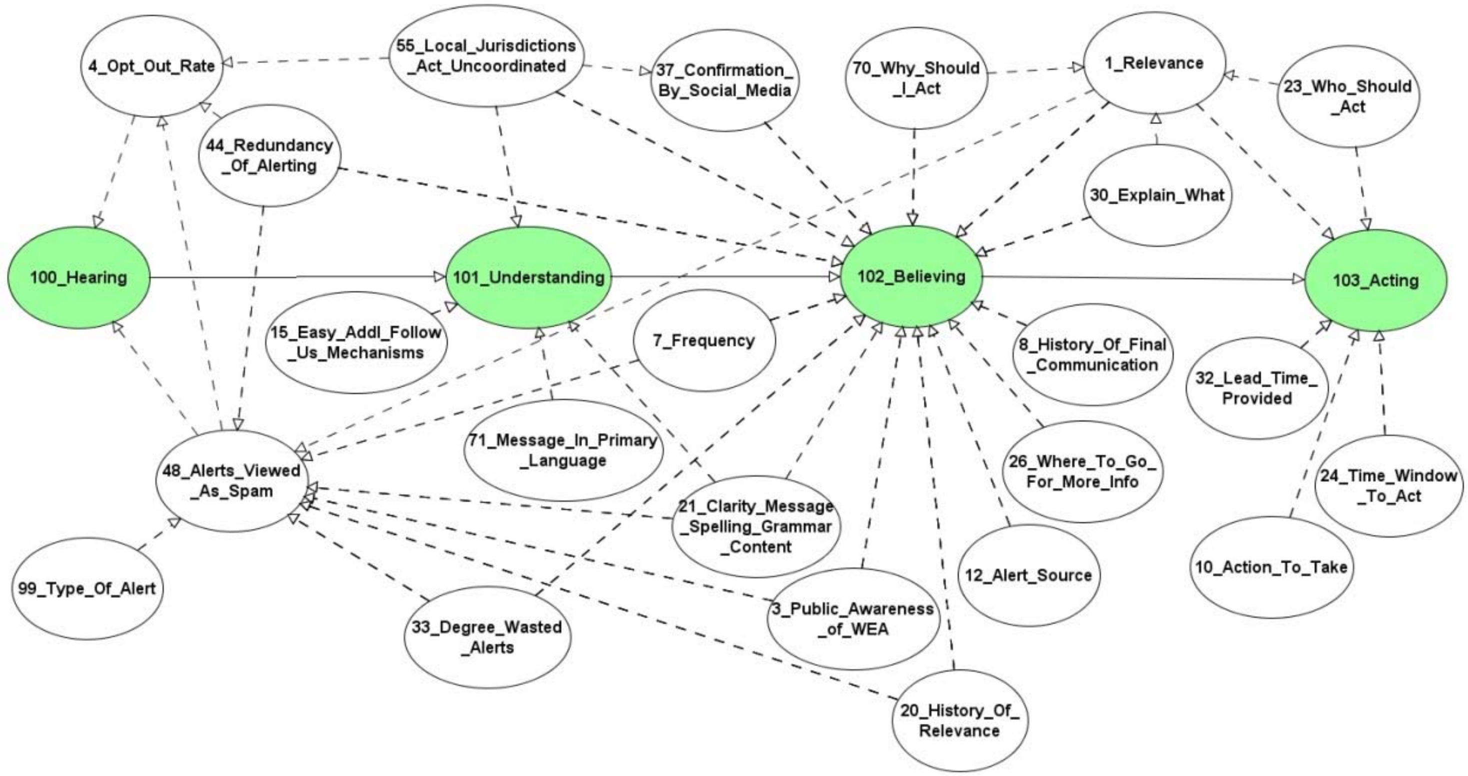

Figure 9: Public Trust Model Condensed

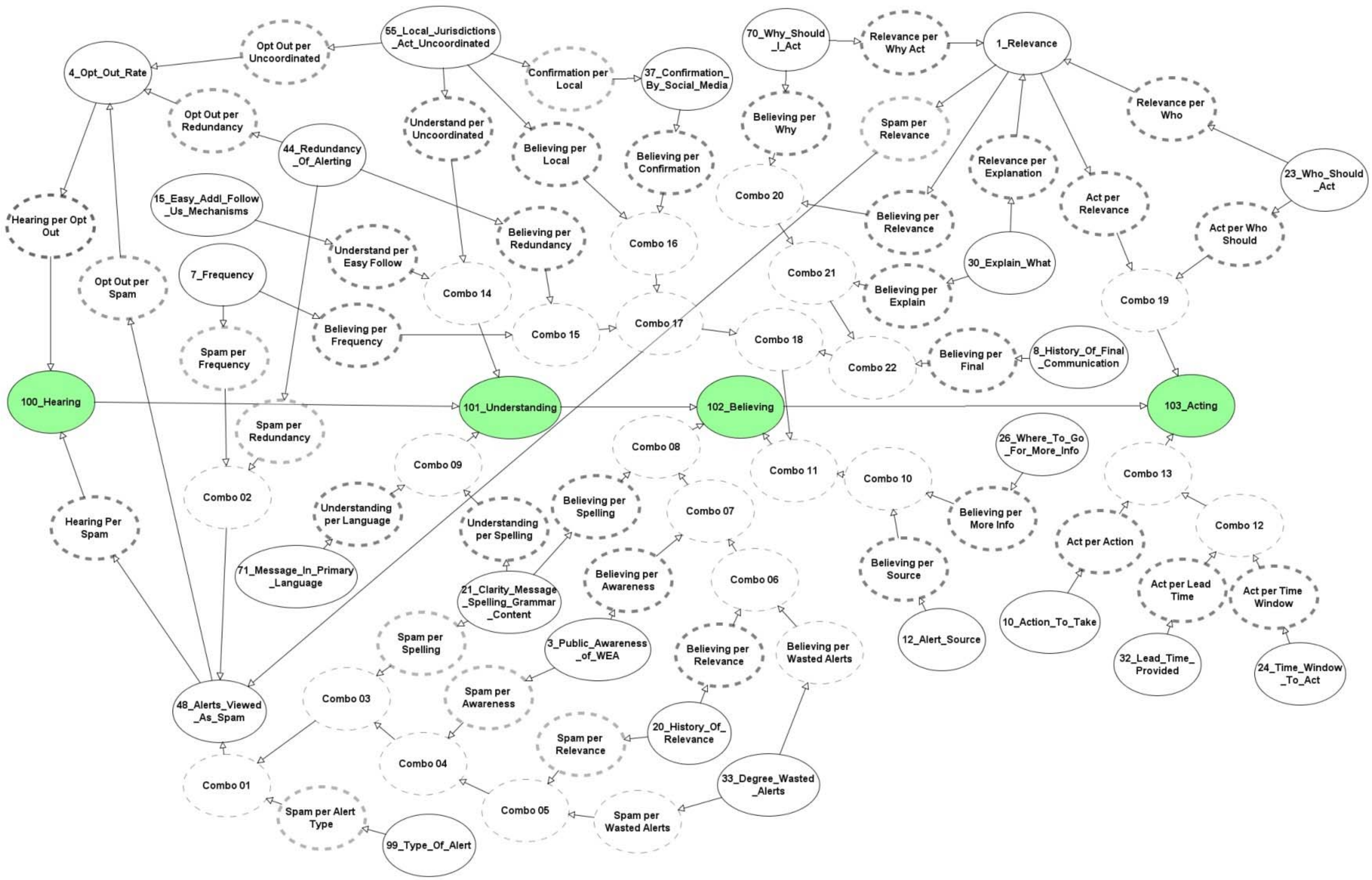

Figure 10: Public Trust Model Expanded

Appendix I Alert Originator Trust Model

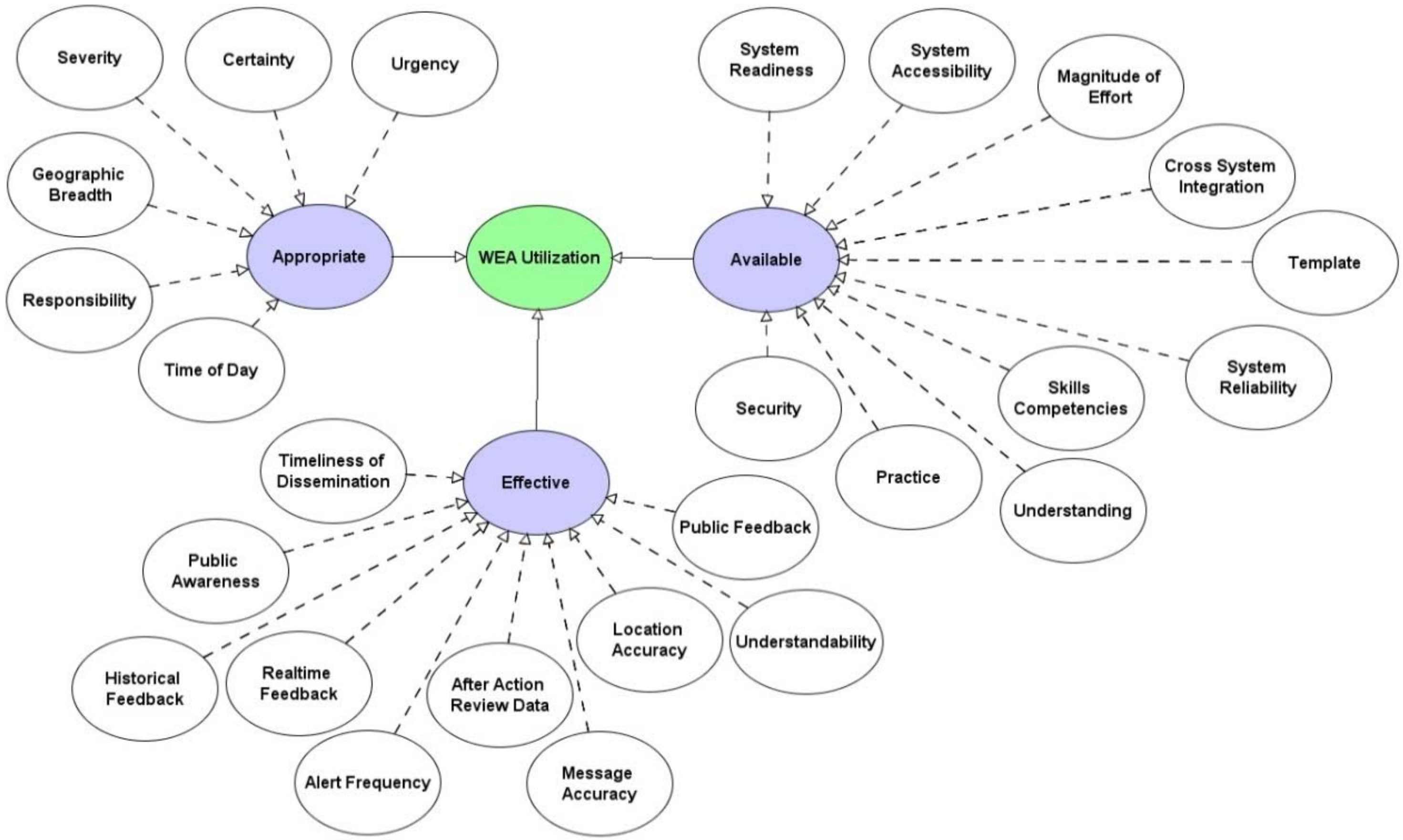

Figure 11: Alert Originator Trust Model Condensed

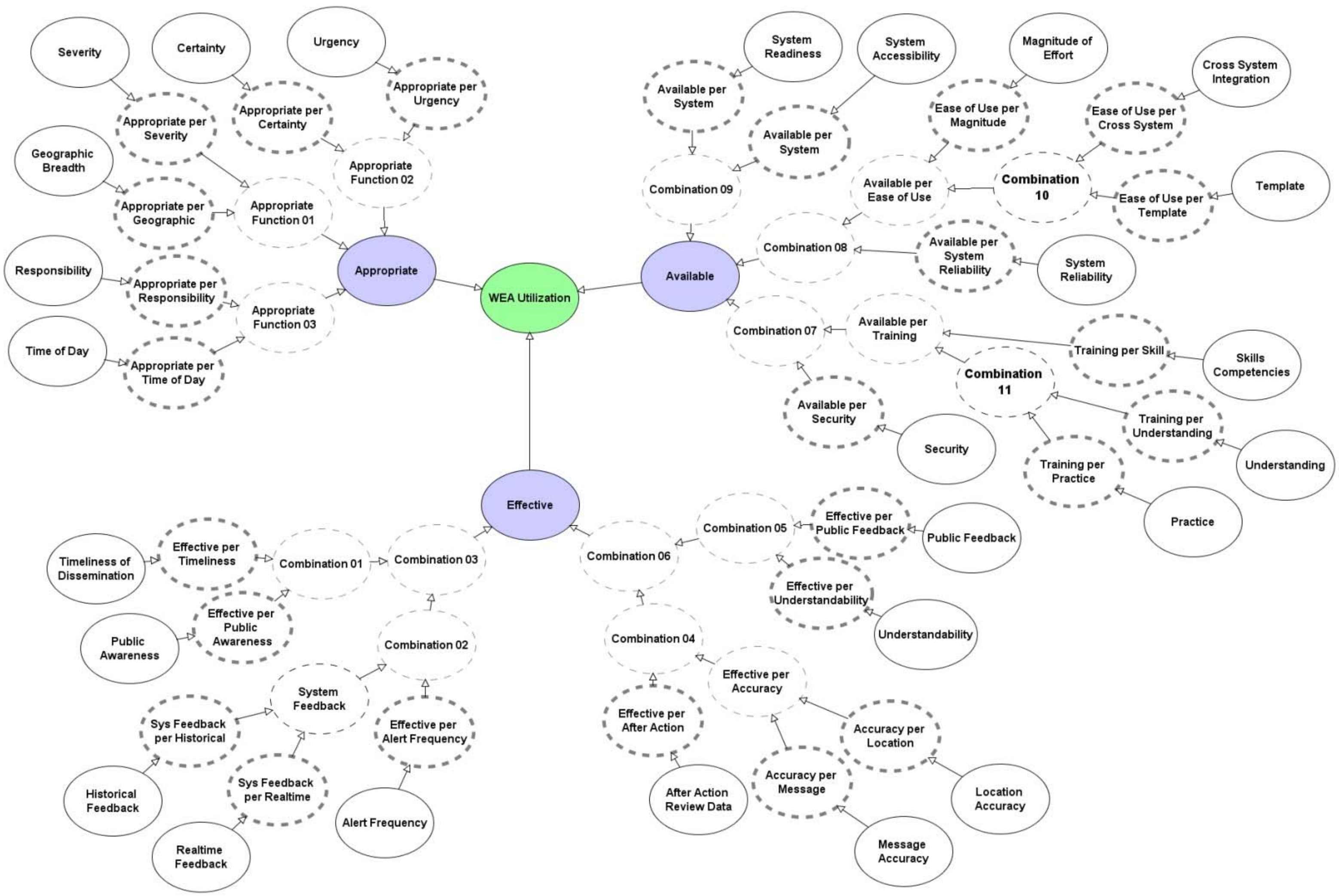

Figure 12: Alert Originator Trust Model Expanded

Appendix J Public Surveys

Public Survey 1

Q1: A Survey for the Wireless Emergency Alert Service

WEA Background

The Wireless Emergency Alerts (WEA) service is a partnership between the FCC, FEMA, and wireless carriers, whose purpose is to enhance public safety. WEA enables authorized federal, state, and local government authorities to send geographically targeted, text-like alerts to the public via wireless mobile devices such as cell phones and tablets. This service can deliver alerts from the president of the United States, AMBER alerts, and alerts regarding imminent local threats such as floods, chemical spills, civil unrest, etc., to all compatible mobile devices within the geographic area specified by the originator of the alert.

On compatible mobile devices, WEA uses a unique signal and vibration to attract attention. WEA messages will not have to be opened like SMS text messages, but will pop up on the device's screen. The public does not need to sign up to receive WEA messages – participating cell carriers will sell WEA-capable phones with the service already opted-in, and there is no charge for the WEA service or the messages you receive.

This Survey

The purpose of this survey is to help government authorities use WEA in a manner that enhances public safety. For WEA to be effective, alert originators must be able to issue alerts that are received, understood, believed, and acted upon by the public. This survey explores several factors that influence public response to alerts.

Q2: Online Consent

This survey is part of a research study conducted by Robert W. Stoddard II at Carnegie Mellon University. The purpose of the research is to study the factors that may influence the public's or alert originator's trust in the soon-to-be-deployed United States Wireless Emergency Alert (WEA) notification system.

Procedures

Survey recipients will be asked approximately 20 multiple choice questions regarding their reactions to different aspects and content of potential alert messages. The survey is expected to take no more than 5-7 minutes.

Participant Requirements

Participation in this study is limited to individuals age 18 and older. Participants must currently use some form of a cellular phone.

Risks

The discomfort and risk associated with participation in this study are no greater than those ordinarily encountered in daily life or during other online activities. Discomfort may arise from the need to maintain focus and attention when responding to the 20 multiple choice questions that include repetition and subtle differences within the message content. The risk of a breach of confidentiality resulting in the inadvertent release of email addresses will be managed by the researcher by ensuring secure access to this information through password control of the online survey tool, subsequent removal of the information from the online system, and archival storage in a secured filing cabinet under control of the researcher.

Benefits

There may be no personal benefit from your participation in the study but the knowledge received may be of value to humanity. Respondents will be notified of a future, free, invitation-only webinar providing more detail of the Wireless Emergency Alert system.

Compensation and Costs

There is no compensation for participation in this study. There will be no cost to you if you participate in this study.

Confidentiality

By participating in this research, you understand and agree that Carnegie Mellon may be required to disclose your consent form, data, and other personally identifiable information as required by law, regulation, subpoena, or court order. Otherwise, your confidentiality will be maintained in the following manner: Your data and consent form will be kept separate. Your consent form will be stored in a locked location on Carnegie Mellon property and will not be disclosed to third parties. By participating, you understand and agree that the data and information gathered during this study may be used by Carnegie Mellon and published and/or disclosed by Carnegie Mellon to others outside of Carnegie Mellon. However, your name, address, contact information and other direct personal identifiers in your consent form will not be mentioned in any such publication or dissemination of the research data and/or results by Carnegie Mellon.

Right to Ask Questions & Contact Information

If you have any questions about this study, you should feel free to ask them by contacting the Principal Investigator now at Robert W. Stoddard II, Principal Researcher, Software Engineering Institute, Carnegie Mellon University, 4500 Fifth Avenue (Office 3110), Pittsburgh, PA 15213, 412-268-1121, rws@sei.cmu.edu. If you have questions later, desire additional information, or wish to withdraw your participation please contact the Principle Investigator by mail, phone, or e-mail in accordance with the contact information listed above.

If you have questions pertaining to your rights as a research participant; or to report objections to this study, you should contact the Research Regulatory Compliance Office at Carnegie Mellon University. Email: irb-review@andrew.cmu.edu. Phone: 412-268-1901 or 412-268-5460.

Voluntary Participation

Your participation in this research is voluntary. You may discontinue participation at any time during the research activity.

Q3: Please answer the following three questions related to your consent. If you answer "No" to any question, you will be ineligible to take the survey.

	Yes (1)	No (2)
Are you age 18 or older? (1)	❍	❍
Have you read and do you understand the previous online consent information? (2)	❍	❍
Do you want to participate in this research and continue with the survey? (3)	❍	❍

NOTE: Q4 through Q24 are presented only if the respondent answers "Yes" to all questions in Q3.

Q4: Instructions

Each of the following survey questions presents you with a situation, and asks you to estimate the likelihood of a particular response to that situation. The choices for your answer are

Definitely Not	I would respond to the situation less than 5% of the time
Very Probably Not	I would respond to the situation 5–20% of the time
Probably Not	I would respond to the situation 20–40% of the time
Undecided	I would respond to the situation 40–60% of the time
Probably	I would respond to the situation 60–80% of the time
Very Probably	I would respond to the situation 80–95% of the time
Definitely	I would respond to the situation more than 95% of the time

Q5: How likely are you to believe a WEA message if you determine that the message is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, or it does not address an emergency that will affect you)?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q6: At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA message: "Hazardous Materials Warning in this area until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to take action in response to this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q7: At 8:05 PM, your cell phone receives and displays the following WEA message: "Fire Warning in this area until 08:49 PM. Evacuate now State Police." How likely are you to believe this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q8: How likely are you to believe a WEA message if you have received prior WEA messages that have not been relevant to you (e.g., they did not apply to your location, they were not issued in a timely manner, or they did not address an emergency that affected you)?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q9: At 8:05 PM, your cell phone receives and displays the following WEA message: "Hazardous Materials Warning in this area until 08:49 PM. Take shelter now." How likely are you to understand this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q10: At 8:05 PM, your cell phone receives and displays the following WEA message: "Hazerdus Mateirals Warning in this area until 08:49 PM. Take shelter now." How likely are you to view this message as spam?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q11: You are in ZIP code 12345 in the town of Kent when your cell phone receives and displays the following WEA message: "Hazardous Materials Warning until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to view this message as relevant to you?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q12: You are in ZIP code 12345 in the town of Kent when your cell phone receives and displays the following WEA message: "Hazardous Materials Warning until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to take action in response to this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q13: How likely are you to believe a WEA message received on your mobile phone if you have not previously been made aware of the WEA program via other means (e.g., newspaper articles, mobile service provider mailings, and TV and radio news stories)?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q14: At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA message "Gunfire in this area Take shelter now. Kent PD" How likely are you to view this message as relevant to you?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q15: At 8:05 PM, your cell phone receives and displays the following WEA message: "Severe Hailstorm Warning in this area from 08:35 until 9:30 PM. Take shelter now." How likely are you to take action in response to this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q16: How likely are you to opt out of the WEA service if you can confirm WEA message information via other channels such as radio or TV news?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q17: How likely are you to opt out of the WEA service if you view the WEA messages that you receive as spam?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q18: How likely are you to opt out of the WEA service if you receive multiple WEA messages from different alert originators (e.g., local emergency manager, county emergency manager, state emergency manager) that are not coordinated, or do not agree?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q19: How likely are you to believe a WEA message if you typically receive them twice each month?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q20: How likely are you to view a WEA message as spam if you typically receive them twice a week?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q21: At 8:05 PM, your cell phone receives and displays the following WEA message: "Nuclear Power Plant Warning in this area Take shelter now." How likely are you to view this message as relevant to you?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q22: At 8:05 PM, your cell phone receives and displays the following WEA message: "Nuclear Power Plant Warning in this area Take shelter now to avoid radiation exposure." How likely are you to believe this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q23: At 8:05 PM, your cell phone receives and displays a WEA message from the President of the United States describing an emergency event of national importance. How likely are you to view this message as spam?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q24: That concludes the WEA survey. Thank you again for your time in helping us to improve the WEA deployment! Please advance forward one last screen for the final capture of your answers.

Note: Q25 is presented only if the respondent answers “No” to any question in Q3.

Q25: We’re sorry that you’ve chosen not to participate in our survey. Thank you for your time!

Public Survey 2

Q1: A Survey for the Wireless Emergency Alert Service

WEA Background

The Wireless Emergency Alerts (WEA) service is a partnership between the FCC, FEMA, and wireless carriers, whose purpose is to enhance public safety. WEA enables authorized federal, state, and local government authorities to send geographically targeted, text-like alerts to the public via wireless mobile devices such as cell phones and tablets. This service can deliver alerts from the president of the United States, AMBER alerts, and alerts regarding imminent local threats such as floods, chemical spills, civil unrest, etc., to all compatible mobile devices within the geographic area specified by the originator of the alert.

On compatible mobile devices, WEA uses a unique signal and vibration to attract attention. WEA messages will not have to be opened as do SMS text messages, but will pop up on the device's screen. The public does not need to sign up to receive WEA messages – participating cell carriers will sell WEA-capable phones with the service already opted-in, and there is no charge for the WEA service or the messages you receive.

This Survey

The purpose of this survey is to help government authorities use WEA in a manner that enhances public safety. For WEA to be effective, alert originators must be able to issue alerts that are received, understood, believed, and acted upon by the public. This survey explores several factors that influence public response to alerts.

Q2: Online Consent

This survey is part of a research study conducted by Robert W. Stoddard II at Carnegie Mellon University. The purpose of the research is to study the factors that may influence the public's or alert originator's trust in the soon-to-be-deployed United States Wireless Emergency Alert (WEA) notification system.

Procedures

Survey recipients will be asked approximately 20 multiple choice questions regarding their reactions to different aspects and content of potential alert messages. The survey is expected to take no more than 5-7 minutes.

Participant Requirements

Participation in this study is limited to individuals age 18 and older. Participants must currently use some form of a cellular phone.

Risks

The discomfort and risk associated with participation in this study are no greater than those ordinarily encountered in daily life or during other online activities. Discomfort may arise from the need to maintain focus and attention when responding to the 20 multiple choice questions that include repetition and subtle differences within the message content. The risk of a breach of confidentiality resulting in the inadvertent release of email addresses will be managed by the researcher by ensuring secure access to this information through password control of the online survey tool, subsequent removal of the information from the online system, and archival storage in a secured filing cabinet under control of the researcher.

Benefits

There may be no personal benefit from your participation in the study but the knowledge received may be of value to humanity. Respondents will be notified of a future, free, invitation-only webinar providing more detail of the Wireless Emergency Alert system.

Compensation and Costs

There is no compensation for participation in this study. There will be no cost to you if you participate in this study.

Confidentiality

By participating in this research, you understand and agree that Carnegie Mellon may be required to disclose your consent form, data, and other personally identifiable information as required by law, regulation, subpoena, or court order. Otherwise, your confidentiality will be maintained in the following manner: Your data and consent form will be kept separate. Your consent form will be stored in a locked location on Carnegie Mellon property and will not be disclosed to third parties. By participating, you understand and agree that the data and information gathered during this study may be used by Carnegie Mellon and published and/or disclosed by Carnegie Mellon to others outside of Carnegie Mellon. However, your name, address, contact information and other direct personal identifiers in your consent form will not be mentioned in any such publication or dissemination of the research data and/or results by Carnegie Mellon.

Right to Ask Questions and Contact Information

If you have any questions about this study, you should feel free to ask them by contacting the Principal Investigator now at Robert W. Stoddard II, Principal Researcher, Software Engineering Institute, Carnegie Mellon University, 4500 Fifth Avenue (Office 3110), Pittsburgh, PA 15213, 412-268-1121, rws@sei.cmu.edu. If you have questions later, desire additional information, or wish to withdraw your participation please contact the Principle Investigator by mail, phone, or e-mail in accordance with the contact information listed above.

If you have questions pertaining to your rights as a research participant; or to report objections to this study, you should contact the Research Regulatory Compliance Office at Carnegie Mellon University. Email: irb-review@andrew.cmu.edu. Phone: 412-268-1901 or 412-268-5460.

Voluntary Participation

Your participation in this research is voluntary. You may discontinue participation at any time during the research activity.

Q3: Please answer the following three questions related to your consent. If you answer "No" to any question, you will be ineligible to take the survey.

	Yes (1)	No (2)
Are you age 18 or older? (1)	❍	❍
Have you read and do you understand the previous online consent information? (2)	❍	❍
Do you want to participate in this research and continue with the survey? (3)	❍	❍

NOTE: Q4 through Q25 are presented only if the respondent answers "Yes" to all questions in Q3.

Q4: Instructions

Each of the following survey questions presents you with a situation, and asks you to estimate the likelihood of a particular response to that situation. The choices for your answer are

Definitely Not	I would respond to the situation less than 5% of the time
Very Probably Not	I would respond to the situation 5–20% of the time
Probably Not	I would respond to the situation 20–40% of the time
Undecided	I would respond to the situation 40–60% of the time
Probably	I would respond to the situation 60–80% of the time
Very Probably	I would respond to the situation 80–95% of the time
Definitely	I would respond to the situation more than 95% of the time

Q5: How likely are you to take action in response to a WEA message if you determine that the message is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, or it does not address an emergency that will affect you)?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q6 At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA message: "Hazardous Materials Warning in this area until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to take action in response to this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q7: At 8:05 PM, your cell phone receives and displays the following WEA message: "Fire Warning in this area until 08:49 PM. Evacuate now State Police." How likely are you to believe this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q8: How likely are you to view a WEA message as scam if you have received prior WEA alerts that have not been relevant to you (e.g., they did not apply to your location, they were not issued in a timely manner, or they did not address an emergency that affected you)?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q9: At 8:05 PM, your cell phone receives and displays the following WEA message: Hazerdus Mateirals Warning in this area until 08:49 PM. Take shelter now." How likely are you to understand this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q10: You are in ZIP code 12345 in the town of Kent when your cell phone receives and displays the following WEA message: "Hazardous Materials Warning in ZIP 12330 and 12345 until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to view this message as relevant to you?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q11: You are in ZIP code 12345 in the town of Kent when your cell phone receives and displays the following WEA message: "Hazardous Materials Warning in this area until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to view this message as relevant to you?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q12: At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA message: "Hazardous Materials Warning in this area Take shelter now. Kent Fire Dept." How likely are you to take action in response to this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q13: How likely are you to view a WEA message received on your mobile phone as spam if you have not previously been made aware of the WEA program via other means (e.g., newspaper articles, mobile service provider mailings, and TV and radio news stories)?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q14: At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA message: "Law Enforcment Warning in this area. Take shelter now. Kent PD" How likely are you to believe this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q15: At 8:05 PM, your cell phone receives and displays the following WEA message: “Severe Hailstorm Warning in this area from 09:35 until 10:30 PM. Take shelter now.” How likely are you to take action in response to this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q16: How likely are you to believe WEA message that you receive if you cannot find confirmation of the information on social media (e.g., Twitter, Facebook)?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q17: How likely are you to view a WEA message as spam if you cannot confirm message information via other channels such as radio or TV news?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q18: How likely are you to believe a WEA service if you receive multiple WEA alerts from different alert originators (e.g., local emergency manager, county emergency manager, state emergency manager) that are not coordinated, or do not agree?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q19: How likely are you to believe a WEA message if you typically receive them twice each day?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q20: How likely are you to believe a WEA message as spam if you typically receive them twice each year?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q21: How likely are you to view a WEA message as spam if you typically receive them twice a month?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q22: At 8:05 PM, your cell phone receives and displays the following WEA message: "Nuclear Power Plant Warning in this area Take shelter now to avoid radiation exposure" How likely are you to view this message as relevant to you?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q23: How likely are you to understand a WEA message that you receive if it is issued in a language that you understand, but one that is not your primary language. (i.e., The WEA message is issued in English. Your primary language is Spanish, but you also speak English)?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q24: At 8:05 PM, your cell phone receives and displays a WEA message from a state emergency management agency regarding an emergency in your area such as a weather event, a chemical spill, or a wild fire. How likely are you to view this alert as spam?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q25: That concludes the WEA survey. Thank you again for your time in helping us to improve the WEA deployment! Please advance forward one last screen for the final capture of your answers.

Note: Q26 is presented only if the respondent answers “No” to any question in Q3.

Q26: We’re sorry that you’ve chosen not to participate in our survey. Thank you for your time!

Public Survey 3

Q1: A Survey for the Wireless Emergency Alert Service

WEA Background

The Wireless Emergency Alerts (WEA) service is a partnership between the FCC, FEMA, and wireless carriers, whose purpose is to enhance public safety. WEA enables authorized federal, state, and local government authorities to send geographically targeted, text-like alerts to the public via wireless mobile devices such as cell phones and tablets. This service can deliver alerts from the president of the United States, AMBER alerts, and alerts regarding imminent local threats such as floods, chemical spills, civil unrest, etc., to all compatible mobile devices within the geographic area specified by the originator of the alert.

On compatible mobile devices, WEA uses a unique signal and vibration to attract attention. WEA messages will not have to be opened as do SMS text messages, but will pop up on the device's screen. The public does not need to sign up to receive WEA messages – participating cell carriers will sell WEA-capable phones with the service already opted-in, and there is no charge for the WEA service or the messages you receive.

This Survey

The purpose of this survey is to help government authorities use WEA in a manner that enhances public safety. For WEA to be effective, alert originators must be able to issue alerts that are received, understood, believed, and acted upon by the public. This survey explores several factors that influence public response to alerts.

Q2: Online Consent

This survey is part of a research study conducted by Robert W. Stoddard II at Carnegie Mellon University. The purpose of the research is to study the factors that may influence the public's or alert originator's trust in the soon-to-be-deployed United States Wireless Emergency Alert (WEA) notification system.

Procedures

Survey recipients will be asked approximately 20 multiple choice questions regarding their reactions to different aspects and content of potential alert messages. The survey is expected to take no more than 5-7 minutes.

Participant Requirements

Participation in this study is limited to individuals age 18 and older. Participants must currently use some form of a cellular phone.

Risks

The discomfort and risk associated with participation in this study are no greater than those ordinarily encountered in daily life or during other online activities. Discomfort may arise from the need to maintain focus and attention when responding to the 20 multiple choice questions that include repetition and subtle differences within the message content. The risk of a breach of confidentiality resulting in the inadvertent release of email addresses will be managed by the researcher by ensuring secure access to this information through password control of the online survey tool, subsequent removal of the information from the online system, and archival storage in a secured filing cabinet under control of the researcher.

Benefits

There may be no personal benefit from your participation in the study but the knowledge received may be of value to humanity. Respondents will be notified of a future, free, invitation-only webinar providing more detail of the Wireless Emergency Alert system.

Compensation and Costs

There is no compensation for participation in this study. There will be no cost to you if you participate in this study.

Confidentiality

By participating in this research, you understand and agree that Carnegie Mellon may be required to disclose your consent form, data, and other personally identifiable information as required by law, regulation, subpoena, or court order. Otherwise, your confidentiality will be maintained in the following manner: Your data and consent form will be kept separate. Your consent form will be stored in a locked location on Carnegie Mellon property and will not be disclosed to third parties. By participating, you understand and agree that the data and information gathered during this study may be used by Carnegie Mellon and published and/or disclosed by Carnegie Mellon to others outside of Carnegie Mellon. However, your name, address, contact information and other direct personal identifiers in your consent form will not be mentioned in any such publication or dissemination of the research data and/or results by Carnegie Mellon.

Right to Ask Questions and Contact Information

If you have any questions about this study, you should feel free to ask them by contacting the Principal Investigator now at Robert W. Stoddard II, Principal Researcher, Software Engineering Institute, Carnegie Mellon University, 4500 Fifth Avenue (Office 3110), Pittsburgh, PA 15213, 412-268-1121, rws@sei.cmu.edu. If you have questions later, desire additional information, or wish to withdraw your participation please contact the Principle Investigator by mail, phone, or e-mail in accordance with the contact information listed above.

If you have questions pertaining to your rights as a research participant; or to report objections to this study, you should contact the Research Regulatory Compliance Office at Carnegie Mellon University. Email: irb-review@andrew.cmu.edu. Phone: 412-268-1901 or 412-268-5460.

Voluntary Participation

Your participation in this research is voluntary. You may discontinue participation at any time during the research activity.

Q3: Please answer the following three questions related to your consent. If you answer "No" to any question, you will be ineligible to take the survey.

	Yes (1)	No (2)
Are you age 18 or older? (1)	❍	❍
Have you read and do you understand the previous online consent information? (2)	❍	❍
Do you want to participate in this research and continue with the survey? (3)	❍	❍

NOTE: Q4 through Q25 are presented only if the respondent answers "Yes" to all questions in Q3.

Q4: Instructions

Each of the following survey questions presents you with a situation, and asks you to estimate the likelihood of a particular response to that situation. The choices for your answer are

Definitely Not	I would respond to the situation less than 5% of the time
Very Probably Not	I would respond to the situation 5–20% of the time
Probably Not	I would respond to the situation 20–40% of the time
Undecided	I would respond to the situation 40–60% of the time
Probably	I would respond to the situation 60–80% of the time
Very Probably	I would respond to the situation 80–95% of the time
Definitely	I would respond to the situation more than 95% of the time

Q5: How likely are you to view a WEA message as spam if you determine that the message is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, or it does not address an emergency that affects you)?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q6 At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA message: "Hazardous Materials Warning in this area until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to take action in response to this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q7: At 8:05 PM, your cell phone receives and displays the following WEA message: "Fire Warning in this area until 08:49 PM. Evacuate now State Police." How likely are you to believe this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q8: How likely are you to view a WEA message as scam if you have received prior WEA alerts that have not been relevant to you (e.g., they did not apply to your location, they were not issued in a timely manner, or they did not address an emergency that affected you)?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q9: At 8:05 PM, your cell phone receives and displays the following WEA message: "Hazerdus Mateirals Warning in this area until 08:49 PM. Take shelter now." How likely are you to understand this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q10: You are in ZIP code 12345 in the town of Kent when your cell phone receives and displays the following WEA message: "Hazardous Materials Warning in ZIP 12330 and 12345 until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to view this message as relevant to you?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q11: You are in ZIP code 12345 in the town of Kent when your cell phone receives and displays the following WEA message: "Hazardous Materials Warning in this area until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to view this message as relevant to you?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q12: At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA message: "Hazardous Materials Warning in this area Take shelter now. Kent Fire Dept." How likely are you to take action in response to this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q13: How likely are you to view a WEA message received on your mobile phone as spam if you have not previously been made aware of the WEA program via other means (e.g., newspaper articles, mobile service provider mailings, and TV and radio news stories)?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q14: At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA message: "Law Enforcment Warning in this area. Take shelter now. Kent PD" How likely are you to believe this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q15: At 8:05 PM, your cell phone receives and displays the following WEA message: "Severe Hailstorm Warning in this area from 09:35 until 10:30 PM. Take shelter now." How likely are you to take action in response to this message?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q16: How likely are you to believe WEA message that you receive if you cannot find confirmation of the information on social media (e.g., Twitter, Facebook)?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q17: How likely are you to view a WEA message as spam if you cannot confirm message information via other channels such as radio or TV news?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q18: How likely are you to believe a WEA service if you receive multiple WEA alerts from different alert originators (e.g., local emergency manager, county emergency manager, state emergency manager) that are not coordinated, or do not agree?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q19: How likely are you to believe a WEA message if you typically receive them twice each day?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q20: How likely are you to believe a WEA message as spam if you typically receive them twice each year?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q21: How likely are you to view a WEA message as spam if you typically receive them twice a month?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q22: At 8:05 PM, your cell phone receives and displays the following WEA message: "Nuclear Power Plant Warning in this area Take shelter now to avoid radiation exposure." How likely are you to view this message as relevant to you?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q23: How likely are you to understand a WEA message that you receive if it is issued in a language that you understand, but one that is not your primary language. (i.e., The WEA message is issued in English. Your primary language is Spanish, but you also speak English)?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q24: At 8:05 PM, your cell phone receives and displays a WEA message from a state emergency management agency regarding an emergency in your area such as a weather event, a chemical spill, or a wild fire. How likely are you to view this alert as spam?

- Definitely Not (1)
- Very Probably Not (2)
- Probably Not (3)
- Undecided (4)
- Probably (5)
- Very Probably (6)
- Definitely (7)

Q25: That concludes the WEA survey. Thank you again for your time in helping us to improve the WEA deployment! Please advance forward one last screen for the final capture of your answers.

Note: Q26 is presented only if the respondent answers “No” to any question in Q3.

Q26: We’re sorry that you’ve chosen not to participate in our survey. Thank you for your time!

Appendix K Mapping of Public Trust Model Relationships to Survey Questions

Factor Relationship			Analysis	#	Qualtrics		Question
23_Who should act	⇒	1_Relevance	delta	15	2.06	s2q10	You are in ZIP code 12345 in the town of Kent when your cell phone receives and displays the following WEA alert "Hazardous Materials Warning in ZIP 12330 and 12345 until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to view this alert as relevant to you?
				16	3.06	s3q10	You are in ZIP code 12345 in the town of Kent when your cell phone receives and displays the following WEA alert "Hazardous Materials Warning in this area until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to view this alert as relevant to you?
				17	1.07	s1q11	You are in ZIP code 12345 in the town of Kent when your cell phone receives and displays the following WEA alert "Hazardous Materials Warning until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to view this alert as relevant to you?

Factor Relationship			Analysis	#	Qualtrics		Question
30_ Explain what (has happened)	⇒	1_Relevance	delta	11	3.09	s3q13	At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA alert "Law Enforcement Warning in this area Take shelter now. Kent PD" How likely are you to view this alert as relevant to you?
				12	1.1	s1q14	At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA alert "Gunfire in this area Take shelter now. Kent PD" How likely are you to view this alert as relevant to you?
70_Why I should act	⇒	1_Relevance	delta	13	1.18	s1q21	At 8:05 PM, your cell phone receives and displays the following WEA alert "Nuclear Power Plant Warning in this area Take shelter now" How likely are you to view this alert as relevant to you?
				14	2.18	s2q22	At 8:05 PM, your cell phone receives and displays the following WEA alert "Nuclear Power Plant Warning in this area Take shelter now to avoid radiation exposure" How likely are you to view this alert as relevant to you?
1_Relevance	⇒	100_Believing	direct	25	1.01	s1q5	How likely are you to believe a WEA Alert if you determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, it does not address an emergency that will affect you)?

Factor Relationship			Analysis	#	Qualtrics		Question
12_Alert source	⇒	100_Believing	delta	29	3.02	s3q6	At 8:05 PM, your cell phone receives and displays the following WEA alert "Fire Warning in this area until 08:49 PM. Evacuate now Local PD" How likely are you to believe this alert?
				30	1.03	s1q7	At 8:05 PM, your cell phone receives and displays the following WEA alert "Fire Warning in this area until 08:49 PM. Evacuate now State Police" How likely are you to believe this alert?
				31	2.03	s2q7	At 8:05 PM, your cell phone receives and displays the following WEA alert "Fire Warning in this area until 08:49 PM. Evacuate now FBI" How likely are you to believe this alert?
20_History of relevance	⇒	100_Believing	direct	24	1.04	s1q8	How likely are you to believe a WEA alert if you have received prior WEA alerts that have not been relevant to you (e.g., they did not apply to your location, they were not issued in a timely manner, they did not address an emergency that affected you)?

Factor Relationship			Analysis	#	Qualtrics		Question
21_Clarity of message spelling and grammar	⇒	100_Believing	delta	20	3.18	s3q21	At 8:05 PM, your cell phone receives and displays the following WEA alert "Hazerdus Mateirals Warning in this area until 08:49 PM. Take shelter now" How likely are you to believe this alert?
				36	3.04	s3q8	At 8:05 PM, your cell phone receives and displays the following WEA alert "Hazardous Materials Warning in this area until 08:49 PM. Take shelter now" How likely are you to believe this alert?
26_Where to go for more information	⇒	100_Believing	delta	13	1.18	s1q21	At 8:05 PM, your cell phone receives and displays the following WEA alert "Nuclear Power Plant Warning in this area Take shelter now" How likely are you to view this alert as relevant to you?
				38	3.08	s3q12	At 8:05 PM, your cell phone receives and displays the following WEA alert "Nuclear Power Plant Warning in this area Take shelter now Check TV & Radio for more info" How likely are you to believe this alert?
3_Public awareness of WEA	⇒	100_Believing	direct	27	1.09	s1q13	How likely are you to believe a WEA Alert received on your mobile phone if you have not previously been made aware of the WEA program via other means (e.g., newspaper articles, mobile service provider mailings, TV, and radio news stories)?

Factor Relationship			Analysis	#	Qualtrics		Question
30_Explain what has happened	⇒	100_Believing	delta	18	2.1	s2q14	At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA alert "Law Enforcement Warning in this area Take shelter now. Kent PD" How likely are you to believe this alert?
				19	3.1	s3q14	At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA alert "Gunfire in this area Take shelter now. Kent PD" How likely are you to believe this alert?
37_Confirmation via social media	⇒	100_Believing	direct	37	2.12	s2q16	How likely are you to believe a WEA Alert that you receive if you cannot find confirmation of the information on social media (e.g., Twitter, Facebook)?
44_Redundancy of alerting	⇒	100_Believing	direct	22	3.12	s3q15	How likely are you to believe a WEA Alert if you cannot confirm the alert information via other channels such as radio or TV news?
55_Local jurisdictions act uncoordinated	⇒	100_Believing	direct	26	2.14	s2q18	How likely are you to believe a WEA Alert if you receive multiple WEA alerts from different alert originators (e.g., local emergency manager, county emergency manager, state emergency manager) that are not coordinated, or do not agree?
7_Frequency	⇒	100_Believing	delta	32	2.15	s2q19	How likely are you to believe a WEA alert if you typically receive them twice each day?
				33	3.15	s3q18	How likely are you to believe a WEA alert if you typically receive them twice each week?
				34	1.16	s1q19	How likely are you to believe a WEA alert if you typically receive them twice each month?
				35	2.16	s2q20	How likely are you to believe a WEA alert if you typically receive them twice each year?

Factor Relationship			Analysis	#	Qualtrics		Question
70_Explain why I should act	⇒	100_Believing	delta	13	1.18	s1q21)	At 8:05 PM, your cell phone receives and displays the following WEA alert “Nuclear Power Plant Warning in this area Take shelter now” How likely are you to view this alert as relevant to you?
				21	1.19	s1q22	At 8:05 PM, your cell phone receives and displays the following WEA alert “Nuclear Power Plant Warning in this area Take shelter now to avoid radiation exposure” How likely are you to believe this alert?
8_History of final communication	⇒	100_Believing	direct	28	3.19	s3q22	How likely are you to believe a WEA Alert if prior WEA alerts that you have received have not included an “all clear” message after the event has been resolved?
48_ Alerts viewed as spam	⇒	101_Hearing	direct	61	3.13	s3q16	How likely are you to read a WEA alert that you receive if you view WEA alerts as spam?
1_Relevance	⇒	103_Acting	direct	10	2.01	s2q5	How likely are you to take action in response to a WEA Alert if you determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, it does not address an emergency that will affect you)?
10_Action to take	⇒	103_Acting	delta	2	1.02	s1q6	At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA alert “Hazardous Materials Warning in this area until 08:49 PM. Take shelter now. Kent Fire Dept.” How likely are you to take action in response to this alert?
				3	2.02	s2q6	At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA alert “Hazardous Materials Warning in this area until 08:49 PM. Kent Fire Dept.” How likely are you to take action in response to this alert?

Factor Relationship			Analysis	#	Qualtrics		Question
23_Who should act	⇒	103_Acting	delta	7	2.07	s2q11	You are in ZIP code 12345 in the town of Kent when your cell phone receives and displays the following WEA alert "Hazardous Materials Warning in this area until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to take action in response to this alert?
				8	3.07	s3q11	You are in ZIP code 12345 in the town of Kent when your cell phone receives and displays the following WEA alert "Hazardous Materials Warning in ZIP 12330 and 12345 until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to take action in response to this alert?
				9	1.08	s1q12	You are in ZIP code 12345 in the town of Kent when your cell phone receives and displays the following WEA alert "Hazardous Materials Warning until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to take action in response to this alert?
24_Time window to act	⇒	103_Acting	delta	2	1.02	s1q6	At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA alert "Hazardous Materials Warning in this area until 08:49 PM. Take shelter now. Kent Fire Dept." How likely are you to take action in response to this alert?
				4	2.08	s2q12	At 8:05 PM, while in the town of Kent, your cell phone receives and displays the following WEA alert "Hazardous Materials Warning in this area Take shelter now. Kent Fire Dept." How likely are you to take action in response to this alert?

Factor Relationship			Analysis	#	Qualtrics		Question
32_Lead time provided	⇒	103_Acting	delta	5	1.11	s1q15	At 8:05 PM, your cell phone receives and displays the following WEA alert “Severe Hailstorm Warning in this area from 08:35 until 9:30 PM. Take shelter now” How likely are you to take action in response to this alert?
				6	2.11	s2q15	At 8:05 PM, your cell phone receives and displays the following WEA alert “Severe Hailstorm Warning in this area from 09:35 until 10:30 PM. Take shelter now How likely are you to take action in response to this alert?
15_Easy additional follow us mechanisms	⇒	103_Understanding	direct	43	3.03	s3q7	How likely are you to understand a WEA alert that you receive if the sender (e.g. local emergency manager, county emergency manager, state emergency manager) does not have alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.
21_Clarity of message spelling and grammar	⇒	103_Understanding	delta	40	1.05	s1q9	At 8:05 PM, your cell phone receives and displays the following WEA alert “Hazerdus Mateirals Warning in this area until 08:49 PM. Take shelter now” How likely are you to understand this alert?
				41	2.05	s2q9	At 8:05 PM, your cell phone receives and displays the following WEA alert “Hazardous Materials Warning in this area until 08:49 PM. Take shelter now” How likely are you to understand this alert?
55_Local jurisdictions act uncoordinated	⇒	103_Understanding	direct	39	3.14	s3q17	How likely are you to understand a WEA Alert if you receive multiple WEA alerts from different alert originators (e.g. local emergency manager, county emergency manager, state emergency manager) that are not coordinated, or do not agree?

Factor Relationship			Analysis	#	Qualtrics		Question
71_Message in primary language	⇒	103_Understanding	direct	42	2.19	s2q23	How likely are you to understand a WEA Alert that you receive if it is issued in a language that you understand, but one that is not your primary language. (i.e., The WEA alert is issued in English. Your primary language is Spanish, but you also speak English.)
44_Redundancy of alerting	⇒	4_Opt out rate	direct	45	1.13	s1q16	How likely are you to opt out of the WEA service if you can confirm WEA alert information via other channels such as radio or TV news?
48_ Alerts viewed as spam	⇒	4_Opt out rate	direct	46	1.14	s1q17	How likely are you to opt out of the WEA service if you view the WEA alerts that you receive as spam.
55_Local jurisdictions act uncoordinated	⇒	4_Opt out rate	direct	44	1.15	s1q18	How likely are you to opt out of the WEA service if you receive multiple WEA alerts from different alert originators (e.g. local emergency manager, county emergency manager, state emergency manager) that are not coordinated, or do not agree.
1_Relevance	⇒	48_ Alerts viewed as spam	direct	56	3.01	s3q5	How likely are you to view a WEA Alert as spam if you determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, it does not address an emergency that affects you).
20_History of relevance	⇒	48_ Alerts viewed as spam	direct	55	2.04	s2q8	How likely are you to view a WEA Alert as spam if you have received prior WEA alerts that have not been relevant to you (e.g., they did not apply to your location, they were not issued in a timely manner, they did not address an emergency that affected you)?

Factor Relationship			Analysis	#	Qualtrics		Question
21_Clarity of message spelling and grammar	⇒	48_ Alerts viewed as spam	delta	57	3.05	s3q9	At 8:05 PM, your cell phone receives and displays the following WEA alert “Hazerdus Mateirals Warning in this area until 08:49 PM. Take shelter now” How likely are you to view this alert as spam?
				58	1.06	s1q10	At 8:05 PM, your cell phone receives and displays the following WEA alert “Hazardous Materials Warning in this area until 08:49 PM. Take shelter now” How likely are you to view this alert as spam?
3_Public awareness of WEA	⇒	48_ Alerts viewed as spam	direct	54	2.09	s2q13	How likely are you to view a WEA Alert received on your mobile phone as spam if you have previously been made aware of the WEA program via other means (e.g., newspaper articles, mobile service provider mailings, and TV and radio news stories).
44_Redundancy of alerting	⇒	48_ Alerts viewed as spam	direct	59	2.13	s2q17	How likely are you to view a WEA message as spam if you cannot confirm alert information via other channels such as radio or TV news?
7_Frequency	⇒	48_ Alerts viewed as spam	delta	50	3.16	s3q19	How likely are you to view a WEA alert as spam if your typically receive them twice a day
				51	1.17	s1q20	How likely are you to view a WEA alert as spam if your typically receive them twice a week
				52	2.17	s2a21	How likely are you to view a WEA alert as spam if your typically receive them twice a month
				53	3.17	s3q20	How likely are you to view a WEA alert as spam if your typically receive them twice a year

Factor Relationship			Analysis	#	Qualtrics		Question
99_Type of alert	⇒	48_ Alerts viewed as spam	delta	47	1.2	s1q23	At 8:05 PM, your cell phone receives and displays a WEA alert from the President of the United States describing an emergency event of national importance. How likely are you to view this alert as spam?
				48	2.2	s2q24	At 8:05 PM, your cell phone receives and displays a WEA alert from a state emergency management agency regarding an emergency in your area such as a weather event, a chemical spill, or a wildfire? How likely are you to view this alert as spam?
				49	3.2	s3q23	At 8:05 PM, your state emergency management agency issues an AMBER (America's Missing: Broadcast Emergency Response) alert regarding a child abduction in your area. Your cell phone receives and displays this information as a WEA alert. How likely are you to view this alert as spam?

Appendix L Alert Originator Surveys

Alert Originator Survey 1

Q1: A Survey for the Wireless Emergency Alert Service

Dear Public Safety Colleague:

In support of the First Responders Group of the U. S. Department of Homeland Security, the Software Engineering Institute (SEI) of Carnegie Mellon University is performing research to aid Emergency Management Agencies (EMAs) in the adoption and use of the Wireless Emergency Alert (WEA) Service (formerly known as the Commercial Mobile Alert Service, or CMAS). If you are unfamiliar with WEA, please see the notes below. For WEA to be effective, the public must “trust” the alerts that they receive. Furthermore, if alert originators are to use the WEA service, they must “trust” it perform properly. To explore these issues of trust, the SEI is conducting surveys of the public, and surveys of the alert origination community.

As a member of the public safety community, we ask you participate in this voluntary survey to assist us in our efforts to enhance public safety. Completion of the survey should require less than 10 minutes. Participation is limited to individuals 18 years of age or older. As a reward for your participation, survey respondents will receive instructions to access a free, follow-up, invitation-only webinar sharing further details of the WEA system.

Thank you for your assistance in this important study.

Notes on the WEA Service

WEA is a partnership between the FCC, FEMA and wireless carriers. WEA enables federal, state, and local government authorities to send geographically targeted, text-like alerts to the public via wireless mobile devices such as cell phones and tablets. This service can be used to deliver alerts from the President of the United States, AMBER alerts, and alerts regarding imminent local threats such as floods, chemical spills, civil unrest, etc. These alerts are sent to all compatible mobile devices within the geographic area specified by the alert originator. For more information regarding WEA, please see http://www.fema.gov/integrated-public-alert-warning-system.

Q2: Online Consent

This survey is part of a research study conducted by Robert W. Stoddard II at Carnegie Mellon University. The purpose of the research is to study the factors that may influence the public’s or alert originator’s trust in the soon-to-be-deployed U.S. Wireless Emergency Alert (WEA) notification system.

Procedures

Survey recipients will be asked approximately 12 questions regarding their reactions to different aspects and content of potential alert messages. The survey is expected to take no more than 10 minutes.

Participant Requirements

Participation in this study is limited to individuals age 18 and older. Participants must currently use some form of a cellular phone.

Risks

The discomfort and risk associated with participation in this study are no greater than those ordinarily encountered in daily life or during other online activities. Discomfort may arise from the need to maintain focus and attention when responding to the 20 multiple choice questions that include repetition and subtle differences within the message content. The risk of a breach of confidentiality resulting in the inadvertent release of email addresses will be managed by the researcher by ensuring secure access to this information through password control of the online survey tool, subsequent removal of the information from the online system, and archival storage in a secured filing cabinet under control of the researcher.

Benefits

There may be no personal benefit from your participation in the study but the knowledge received may be of value to humanity. Respondents will be notified of a future, free, invitation-only webinar providing more detail of the Wireless Emergency Alert system.

Compensation & Costs

There is no compensation for participation in this study. There will be no cost to you if you participate in this study.

Confidentiality

By participating in this research, you understand and agree that Carnegie Mellon may be required to disclose your consent form, data and other personally identifiable information as required by law, regulation, subpoena or court order. Otherwise, your confidentiality will be maintained in the following manner: Your data and consent form will be kept separate. Your consent form will be stored in a locked location on Carnegie Mellon property and will not be disclosed to third parties. By participating, you understand and agree that the data and information gathered during this study may be used by Carnegie Mellon and published and/or disclosed by Carnegie Mellon to others outside of Carnegie Mellon. However, your name, address, contact information and other direct personal identifiers in your consent form will not be mentioned in any such publication or dissemination of the research data and/or results by Carnegie Mellon.

Right to Ask Questions & Contact Information

If you have any questions about this study, you should feel free to ask them by contacting the Principal Investigator now at Robert W. Stoddard II, Principal Researcher, Software Engineering Institute, Carnegie Mellon University, 4500 Fifth Avenue (Office 3110), Pittsburgh, PA 15213, 412-268-1121, rws@sei.cmu.edu]. If you have questions later, desire additional information, or wish to withdraw your participation please contact the Principle Investigator by mail, phone or e-mail in accordance with the contact information listed above.

If you have questions pertaining to your rights as a research participant; or to report objections to this study, you should contact the Research Regulatory Compliance Office at Carnegie Mellon University. Email: irb-review@andrew.cmu.edu . Phone: 412-268-1901 or 412-268-5460.

Voluntary Participation

Your participation in this research is voluntary. You may discontinue participation at any time during the research activity.

Q3: Please answer the following three questions related to your consent.

If you answer “No” to any question, you will be ineligible to take the survey.

	Yes	No
Are you age 18 or older?	❍	❍
Have you read and do you understand the previous online consent information?	❍	❍
Do you want to participate in this research and continue with the survey?	❍	❍

NOTE: Q4 through Q16 are presented only if the respondent answers “Yes” to all questions in Q3.

Q4: Instructions

Each of the following survey questions presents you with a situation, and asks you to estimate the likelihood of a particular response to that situation. The choices for your answer are

Definitely Not	I would respond to the situation less than 5% of the time.
Very Probably Not	I would respond to the situation 5–20% of the time.
Probably Not	I would respond to the situation 20–40% of the time.
Undecided	I would respond to the situation 40–60% of the time.
Probably	I would respond to the situation 60–80% of the time.
Very Probably	I would respond to the situation 80–95% of the time.
Definitely	I would respond to the situation more than 95% of the time.

Q5: What is the approximate population within your jurisdiction (in thousands)?

Residents ______________

Transients ______________

Q6: Does your agency presently issue public alerts via email, Emergency Notification System, EAS, or other mechanism?

- No
- Yes
- Don’t Know

Q7: Do you think WEA would be an appropriate tool to issue a public alert for an event that requires public action …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
within 10 minutes?	❍	❍	❍	❍	❍	❍	❍
within 30 minutes?	❍	❍	❍	❍	❍	❍	❍
within 60 minutes?	❍	❍	❍	❍	❍	❍	❍
within 2 hours?	❍	❍	❍	❍	❍	❍	❍

Q8: Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event where …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
30% of the alert recipients are in the hazard zone and 70% are outside the zone?	❍	❍	❍	❍	❍	❍	❍
50% of the alert recipients are in the hazard zone and 50% are outside the zone?	❍	❍	❍	❍	❍	❍	❍
70% of the alert recipients are in the hazard zone and 30% are outside the zone?	❍	❍	❍	❍	❍	❍	❍
90% of the alert recipients are in the hazard zone and 10% are outside the zone?	❍	❍	❍	❍	❍	❍	❍

Q9: Are you likely to use WEA to issue a public alert for a severe and urgent event if the WEA service is typically …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
unavailable for use 1 hour per week (i.e., 99.4% availability) for maintenance?	❍	❍	❍	❍	❍	❍	❍
unavailable for use 1 hour per month (i.e., 99.9% availability) for maintenance?	❍	❍	❍	❍	❍	❍	❍
unavailable for use 1 hour per year (i.e., 99.99% availability) for maintenance?	❍	❍	❍	❍	❍	❍	❍

Q10: Are you likely to use WEA to issue a public alert for a severe and urgent event if the process of creating and issuing an alert …

	Definitely Not	Very Proba-bly Not	Probably Not	Maybe	Probably	Very Prob-ably	Definitely
takes 5 minutes	❍	❍	❍	❍	❍	❍	❍
takes 10 minutes	❍	❍	❍	❍	❍	❍	❍
takes 20 minutes	❍	❍	❍	❍	❍	❍	❍
takes 40 minutes	❍	❍	❍	❍	❍	❍	❍

Q11: Are you likely to use WEA to issue a public alert for a severe and urgent event if the creation and issuance of a WEA alert is accomplished using a system that is …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
independent of other alerting and/or emer-gency management systems in your office?	❍	❍	❍	❍	❍	❍	❍
integrated with other alerting and/or emer-gency management systems in your office?	❍	❍	❍	❍	❍	❍	❍

Q12: Are you likely to use WEA to issue a public alert if you believe you have …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
a thorough understanding of the principles and applications of the WEA service	❍	❍	❍	❍	❍	❍	❍
a moderate understanding of the principles and applications of the WEA service	❍	❍	❍	❍	❍	❍	❍
a minimal understanding of the principles and applications of the WEA service	❍	❍	❍	❍	❍	❍	❍

Q13: Would you be confident that the WEA service had delivered your alert if you received …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
no response from the WEA service regarding the status of your alert from IPAWS-OPEN?	❍	❍	❍	❍	❍	❍	❍
a response from the WEA service indicating that your message had been received by IPAWS-OPEN?	❍	❍	❍	❍	❍	❍	❍
a response from the WEA service indicating that your message had been received and accepted by IPAWS-OPEN?	❍	❍	❍	❍	❍	❍	❍
a response from the WEA service indicating that your message had been received and accepted by IPAWS-OPEN, and sent to the wireless carriers?	❍	❍	❍	❍	❍	❍	❍
a response from the WEA service indicating that your message had been received and accepted by IPAWS-OPEN, sent to the wireless carriers, and transmitted by the wireless carriers?	❍	❍	❍	❍	❍	❍	❍

Q14: Are you likely to use WEA to issue a public alert for a severe and urgent event if findings of internal After Action Reviews of prior alerts have been …

	Definitely Not	Very Proba-bly Not	Probably Not	Maybe	Probably	Very Prob-ably	Definitely
unfavorable?	❍	❍	❍	❍	❍	❍	❍
neutral?	❍	❍	❍	❍	❍	❍	❍
favorable?	❍	❍	❍	❍	❍	❍	❍

Q15 Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts have been disseminated …

	Definitely Not	Very Prob-ably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
within 2 minutes of your alert data input?	❍	❍	❍	❍	❍	❍	❍
within 2 to 5 minutes of your alert data input?	❍	❍	❍	❍	❍	❍	❍
within 5 to 10 minutes of your alert data input?	❍	❍	❍	❍	❍	❍	❍
within 10 to 30 minutes of your alert data input?	❍	❍	❍	❍	❍	❍	❍

Q16: Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts sent by WEA have been disseminated …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
to a geographic area other than the one specified?	❍	❍	❍	❍	❍	❍	❍
to the specified geo-graphic area, and also to some adjacent geographic areas?	❍	❍	❍	❍	❍	❍	❍
to only a portion of the specified geographic area?	❍	❍	❍	❍	❍	❍	❍

Alert Originator Survey 2

Q1: A Survey for the Wireless Emergency Alert Service

Dear Public Safety Colleague:

In support of the First Responders Group of the U. S. Department of Homeland Security, the Software Engineering Institute (SEI) of Carnegie Mellon University is performing research to aid Emergency Management Agencies (EMAs) in the adoption and use of the Wireless Emergency Alert (WEA) Service (formerly known as the Commercial Mobile Alert Service, or CMAS). If you are unfamiliar with WEA, please see the notes below. For WEA to be effective, the public must "trust" the alerts that they receive. Furthermore, if alert originators are to use the WEA service, they must "trust" it perform properly. To explore these issues of trust, the SEI is conducting surveys of the public, and surveys of the alert origination community.

As a member of the public safety community, we ask you participate in this voluntary survey to assist us in our efforts to enhance public safety. Completion of the survey should require less than 10 minutes. Participation is limited to individuals 18 years of age or older. As a reward for your participation, survey respondents will receive instructions to access a free, follow-up, invitation-only webinar sharing further details of the WEA system.

Thank you for your assistance in this important study.

Notes on the WEA Service

WEA is a partnership between the FCC, FEMA and wireless carriers. WEA enables federal, state, and local government authorities to send geographically targeted, text-like alerts to the public via wireless mobile devices such as cell phones and tablets. This service can be used to deliver alerts from the President of the United States, AMBER alerts, and alerts regarding imminent local threats such as floods, chemical spills, civil unrest, etc. These alerts are sent to all compatible mobile devices within the geographic area specified by the alert originator. For more information regarding WEA, please see http://www.fema.gov/integrated-public-alert-warning-system.

Q2: Online Consent

This survey is part of a research study conducted by Robert W. Stoddard II at Carnegie Mellon University. The purpose of the research is to study the factors that may influence the public's or alert originator's trust in the soon-to-be-deployed United States Wireless Emergency Alert (WEA) notification system.

Procedures

Survey recipients will be asked approximately 12 questions regarding their reactions to different aspects and content of potential alert messages. The survey is expected to take no more than 10 minutes.

Participant Requirements

Participation in this study is limited to individuals age 18 and older. Participants must currently use some form of a cellular phone.

Risks

The discomfort and risk associated with participation in this study are no greater than those ordinarily encountered in daily life or during other online activities. Discomfort may arise from the need to maintain focus and attention when responding to the 20 multiple choice questions that include repetition and subtle differences within the message content. The risk of a breach of confidentiality resulting in the inadvertent release of email addresses will be managed by the researcher by ensuring secure access to this information through password control of the online survey tool, subsequent removal of the information from the online system, and archival storage in a secured filing cabinet under control of the researcher.

Benefits

There may be no personal benefit from your participation in the study but the knowledge received may be of value to humanity. Respondents will be notified of a future, free, invitation-only webinar providing more detail of the Wireless Emergency Alert system.

Compensation & Costs

There is no compensation for participation in this study. There will be no cost to you if you participate in this study.

Confidentiality

By participating in this research, you understand and agree that Carnegie Mellon may be required to disclose your consent form, data and other personally identifiable information as required by law, regulation, subpoena or court order. Otherwise, your confidentiality will be maintained in the following manner: Your data and consent form will be kept separate. Your consent form will be stored in a locked location on Carnegie Mellon property and will not be disclosed to third parties. By participating, you understand and agree that the data and information gathered during this study may be used by Carnegie Mellon and published and/or disclosed by Carnegie Mellon to others outside of Carnegie Mellon. However, your name, address, contact information and other direct personal identifiers in your consent form will not be mentioned in any such publication or dissemination of the research data and/or results by Carnegie Mellon.

Right to Ask Questions & Contact Information

If you have any questions about this study, you should feel free to ask them by contacting the Principal Investigator now at Robert W. Stoddard II, Principal Researcher, Software Engineering Institute, Carnegie Mellon University, 4500 Fifth Avenue (Office 3110), Pittsburgh, PA 15213, 412-268-1121, rws@sei.cmu.edu]. If you have questions later, desire additional information, or wish to withdraw your participation please contact the Principle Investigator by mail, phone or e-mail in accordance with the contact information listed above.

If you have questions pertaining to your rights as a research participant; or to report objections to this study, you should contact the Research Regulatory Compliance Office at Carnegie Mellon University. Email: irb-review@andrew.cmu.edu . Phone: 412-268-1901 or 412-268-5460.

Voluntary Participation

Your participation in this research is voluntary. You may discontinue participation at any time during the research activity.

Q3: Please answer the following three questions related to your consent. If you answer "No" to any question, you will be ineligible to take the survey.

	Yes	No
Are you age 18 or older?	❍	❍
Have you read and do you understand the previous online consent information?	❍	❍
Do you want to participate in this research and continue with the survey?	❍	❍

NOTE: Q4 through Q16 are presented only if the respondent answers "Yes" to all questions in Q3.

Q4: Instructions

Each of the following survey questions presents you with a situation, and asks you to estimate the likelihood of a particular response to that situation. The choices for your answer are:

Definitely Not	I would respond to the situation less than 5% of the time.
Very Probably Not	I would respond to the situation 5–20% of the time.
Probably Not	I would respond to the situation 20–40% of the time.
Undecided	I would respond to the situation 40–60% of the time.
Probably	I would respond to the situation 60–80% of the time.
Very Probably	I would respond to the situation 80–95% of the time.
Definitely	I would respond to the situation more than 95% of the time.

Q5: What is the approximate population within your jurisdiction (in thousands)?

Residents _______________

Transients _______________

Q6: Does your agency presently issue public alerts via email, Emergency Notification System, EAS, or other mechanism?

- o No
- o Yes
- o Don't Know

Q7: Do you think WEA would be an appropriate tool to issue a public alert for an event that poses …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
an extraordinary threat to life?	❍	❍	❍	❍	❍	❍	❍
significant threat to life?	❍	❍	❍	❍	❍	❍	❍
a possible threat to life?	❍	❍	❍	❍	❍	❍	❍
an extraordinary threat to property?	❍	❍	❍	❍	❍	❍	❍
a significant threat to property?	❍	❍	❍	❍	❍	❍	❍
a possible threat to property?	❍	❍	❍	❍	❍	❍	❍

Q8: Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
that occurs at 10:30 AM	❍	❍	❍	❍	❍	❍	❍
that occurs at 6:30 PM	❍	❍	❍	❍	❍	❍	❍
that occurs at 2:30 AM	❍	❍	❍	❍	❍	❍	❍

Q9: Are you likely to use WEA to issue public alerts if you can access it …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
from several designated facilities (e.g., your Emergency Management office, police precinct stations, etc.) within your jurisdiction, as well as remotely from your mobile device(s)?	❍	❍	❍	❍	❍	❍	❍
only from several designated facilities (e.g., your Emergency Management office, police precinct stations, etc.) within your jurisdiction?	❍	❍	❍	❍	❍	❍	❍
only from your primary office?	❍	❍	❍	❍	❍	❍	❍

Q10: Are you likely to use WEA to issue a public alert for a severe and urgent event if the process of creating and issuing an alert …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
takes 5 minutes	❍	❍	❍	❍	❍	❍	❍
takes 10 minutes	❍	❍	❍	❍	❍	❍	❍
takes 20 minutes	❍	❍	❍	❍	❍	❍	❍
takes 40 minutes	❍	❍	❍	❍	❍	❍	❍

Q11: Are you likely to use WEA to issue a public alert for a severe and urgent event …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
if your message creation process includes the use of templates to assist you in rapidly creating an accurate alert?	❍	❍	❍	❍	❍	❍	❍
if your message creation process does not include the use of templates to assist you in rapidly creating an accurate alert?	❍	❍	❍	❍	❍	❍	❍

Q12: Are you likely to use WEA to issue a public alert if opportunities to practice the skills needed to use the WEA service are …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
Frequent (e.g., twice per week) ?	❍	❍	❍	❍	❍	❍	❍
Occasional (e.g., twice per month) ?	❍	❍	❍	❍	❍	❍	❍
Rare (e.g., twice per year) ?	❍	❍	❍	❍	❍	❍	❍

Q13: Are you likely to use WEA to issue a public alert if …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
you have been unable to verify timely and accurate transmission of prior alerts by the WEA service?	❍	❍	❍	❍	❍	❍	❍
you have verified timely and accurate transmission of prior alerts by the WEA service?	❍	❍	❍	❍	❍	❍	❍
you have verified that prior alerts have not been transmitted in a timely and accurate manner?	❍	❍	❍	❍	❍	❍	❍

Q14: Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts have been disseminated …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
within 2 minutes of your alert data input?	❍	❍	❍	❍	❍	❍	❍
within 2 to 5 minutes of your alert data input?	❍	❍	❍	❍	❍	❍	❍
within 5 to 10 minutes of your alert data input?	❍	❍	❍	❍	❍	❍	❍
within 10 to 30 minutes of your alert data input?	❍	❍	❍	❍	❍	❍	❍

Q15: Are you likely to use WEA to issue a public alert for a severe and urgent event if …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
you are able to issue only “standardized” messages developed by the WEA service based on your CAP inputs?	❍	❍	❍	❍	❍	❍	❍
you can craft any message of your choosing with a maximum size of 90 characters?	❍	❍	❍	❍	❍	❍	❍
you can craft any message of your choosing with a maximum size of 180 characters?	❍	❍	❍	❍	❍	❍	❍
you can craft any message of your choosing with a maximum size of 270 characters?	❍	❍	❍	❍	❍	❍	❍

Q16: Are you likely to use WEA to issue a public alert for a severe and urgent event if the public…

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
has been previously informed about WEA and its capabilities via public media such as newspaper reports, TV news, radio news, and/or your own social media channels (e.g., web site, Facebook page, Twitter account)?	❍	❍	❍	❍	❍	❍	❍
has not been previously informed about WEA and its capabilities via public media such as newspaper reports, TV news, radio news, and/or your own social media channels (e.g., web site, Facebook page, Twitter account)?	❍	❍	❍	❍	❍	❍	❍

Alert Originator Survey 3

Q1: A Survey for the Wireless Emergency Alert Service

Dear Public Safety Colleague:

In support of the First Responders Group of the U.S. Department of Homeland Security, the Software Engineering Institute (SEI) of Carnegie Mellon University is performing research to aid Emergency Management Agencies (EMAs) in the adoption and use of the Wireless Emergency Alert (WEA) Service (formerly known as the Commercial Mobile Alert Service, or CMAS). If you are unfamiliar with WEA, please see the notes below. For WEA to be effective, the public must "trust" the alerts that they receive. Furthermore, if alert originators are to use the WEA service, they must "trust" it perform properly. To explore these issues of trust, the SEI is conducting surveys of the public, and surveys of the alert origination community.

As a member of the public safety community, we ask you participate in this voluntary survey to assist us in our efforts to enhance public safety. Completion of the survey should require less than 10 minutes. Participation is limited to individuals 18 years of age or older. As a reward for your participation, survey respondents will receive instructions to access a free, follow-up, invitation-only webinar sharing further details of the WEA system.

Thank you for your assistance in this important study.

Notes on the WEA Service

WEA is a partnership between the FCC, FEMA and wireless carriers. WEA enables federal, state, and local government authorities to send geographically targeted, text-like alerts to the public via wireless mobile devices such as cell phones and tablets. This service can be used to deliver alerts from the President of the United States, AMBER alerts, and alerts regarding imminent local threats such as floods, chemical spills, civil unrest, etc. These alerts are sent to all compatible mobile devices within the geographic area specified by the alert originator. For more information regarding WEA, please see http://www.fema.gov/integrated-public-alert-warning-system.

Q2: Online Consent

This survey is part of a research study conducted by Robert W. Stoddard II at Carnegie Mellon University. The purpose of the research is to study the factors that may influence the public's or alert originator's trust in the soon-to-be-deployed United States Wireless Emergency Alert (WEA) notification system.

Procedures

Survey recipients will be asked approximately 12 questions regarding their reactions to different aspects and content of potential alert messages. The survey is expected to take no more than 10 minutes.

Participant Requirements

Participation in this study is limited to individuals age 18 and older. Participants must currently use some form of a cellular phone.

Risks

The discomfort and risk associated with participation in this study are no greater than those ordinarily encountered in daily life or during other online activities. Discomfort may arise from the need to maintain focus and attention when responding to the 20 multiple choice questions that include repetition and subtle differences within the message content. The risk of a breach of confidentiality resulting in the inadvertent release of email addresses will be managed by the researcher by ensuring secure access to this information through password control of the online survey tool, subsequent removal of the information from the online system, and archival storage in a secured filing cabinet under control of the researcher.

Benefits

There may be no personal benefit from your participation in the study but the knowledge received may be of value to humanity. Respondents will be notified of a future, free, invitation-only webinar providing more detail of the Wireless Emergency Alert system.

Compensation & Costs

There is no compensation for participation in this study. There will be no cost to you if you participate in this study.

Confidentiality

By participating in this research, you understand and agree that Carnegie Mellon may be required to disclose your consent form, data and other personally identifiable information as required by law, regulation, subpoena or court order. Otherwise, your confidentiality will be maintained in the following manner: Your data and consent form will be kept separate. Your consent form will be stored in a locked location on Carnegie Mellon property and will not be disclosed to third parties. By participating, you understand and agree that the data and information gathered during this study may be used by Carnegie Mellon and published and/or disclosed by Carnegie Mellon to others outside of Carnegie Mellon. However, your name, address, contact information and other direct personal identifiers in your consent form will not be mentioned in any such publication or dissemination of the research data and/or results by Carnegie Mellon.

Right to Ask Questions & Contact Information

If you have any questions about this study, you should feel free to ask them by contacting the Principal Investigator now at Robert W. Stoddard II, Principal Researcher, Software Engineering Institute, Carnegie Mellon University, 4500 Fifth Avenue (Office 3110), Pittsburgh, PA 15213, 412-268-1121, rws@sei.cmu.edu]. If you have questions later, desire additional information, or wish to withdraw your participation please contact the Principle Investigator by mail, phone or e-mail in accordance with the contact information listed above.

If you have questions pertaining to your rights as a research participant; or to report objections to this study, you should contact the Research Regulatory Compliance Office at Carnegie Mellon University. Email: irb-review@andrew.cmu.edu . Phone: 412-268-1901 or 412-268-5460.

Voluntary Participation

Your participation in this research is voluntary. You may discontinue participation at any time during the research activity.

Q3: Please answer the following three questions related to your consent. If you answer "No" to any question, you will be ineligible to take the survey.

	Yes	No
Are you age 18 or older?	❍	❍
Have you read and do you understand the previous online consent information?	❍	❍
Do you want to participate in this research and continue with the survey?	❍	❍

NOTE: Q4 through Q16 are presented only if the respondent answers "Yes" to all questions in Q3.

Q4: Instructions

Each of the following survey questions presents you with a situation, and asks you to estimate the likelihood of a particular response to that situation. The choices for your answer are:

Definitely Not	I would respond to the situation less than 5% of the time.
Very Probably Not	I would respond to the situation 5–20% of the time.
Probably Not	I would respond to the situation 20–40% of the time.
Undecided	I would respond to the situation 40–60% of the time.
Probably	I would respond to the situation 60–80% of the time.
Very Probably	I would respond to the situation 80–95% of the time.
Definitely	I would respond to the situation more than 95% of the time.

Q5: What is the approximate population within your jurisdiction (in thousands)?

Residents _______________

Transients _______________

Q6: Does your agency presently issue public alerts via email, Emergency Notification System, EAS, or other mechanism?

- o No
- o Yes
- o Don't know

Q7: Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event that is …

	Definitely Not	Very Proba-bly Not	Probably Not	Maybe	Probably	Very Prob-ably	Definitely
30% likely to occur?	❍	❍	❍	❍	❍	❍	❍
50% likely to occur?	❍	❍	❍	❍	❍	❍	❍
70% likely to occur?	❍	❍	❍	❍	❍	❍	❍
90% likely to occur?	❍	❍	❍	❍	❍	❍	❍

Q8: Public alerting responsibility is often distributed across multiple emergency management agencies (EMAs) based on the type of alert and location. However, this distribution is not always foolproof due to unclear alert classifications and overlapping jurisdictions (e.g., the jurisdiction of a municipal EMA is within the jurisdiction of a county EMA within the jurisdiction of a state EMA). In some cases, it may be unclear whether or not your EMA has the primary responsibility for issuing an alert. How likely are you to use WEA for an urgent and severe event in your jurisdiction …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
if you are 50% sure that the responsibility for issuing the alert rests with your EMA and not another?	❍	❍	❍	❍	❍	❍	❍
if you are 70% sure that the responsibility for issuing the alert rests with your EMA and not another?	❍	❍	❍	❍	❍	❍	❍
if you are 90% sure that the responsibility for issuing the alert rests with your EMA and not another?	❍	❍	❍	❍	❍	❍	❍
if you are 99% sure that the responsibility for issuing the alert rests with your EMA and not another?	❍	❍	❍	❍	❍	❍	❍

Q9: Are you likely to use WEA to issue a public alert for a severe and urgent event if the service …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
successfully transmits 99.9% of the alerts submitted	❍	❍	❍	❍	❍	❍	❍
successfully transmits 99% of the alerts submitted	❍	❍	❍	❍	❍	❍	❍
successfully transmits 90% of the alerts submitted	❍	❍	❍	❍	❍	❍	❍

Q10: Are you likely to use WEA to issue a public alert for a severe and urgent event if the process of creating and issuing an alert …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
takes 5 minutes	❍	❍	❍	❍	❍	❍	❍
takes 10 minutes	❍	❍	❍	❍	❍	❍	❍
takes 20 minutes	❍	❍	❍	❍	❍	❍	❍
takes 40 minutes	❍	❍	❍	❍	❍	❍	❍

Q11: Are you likely to use WEA to issue a public alert if you have received …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
extensive training (e.g., 40 hours) on the use of the WEA service	❍	❍	❍	❍	❍	❍	❍
adequate training (e.g., 16 hours) on the use of the WEA service	❍	❍	❍	❍	❍	❍	❍
minimal training (4 hours) on the use of the WEA service	❍	❍	❍	❍	❍	❍	❍

Q12: Are you likely to use the WEA service if you are aware of …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
no cyber attacks (e.g., spoofing, tampering, denial of service) on the WEA service reported by any WEA users within the past 12 months?	❍	❍	❍	❍	❍	❍	❍
unsuccessful cyber attacks (e.g., failed attempts at spoofing, tampering, denial of service) on the WEA service reported by any WEA users within the past 12 months?	❍	❍	❍	❍	❍	❍	❍
successful cyber attacks (e.g., spoofing, tampering, denial of service) on the WEA service reported by any WEA users within the past 12 months?	❍	❍	❍	❍	❍	❍	❍
successful cyber attacks (e.g., spoofing, tampering, denial of service) on the WEA service reported by your agency within the past 12 months?	❍	❍	❍	❍	❍	❍	❍

Q13: Are you likely to use WEA to issue a public alert for a severe and urgent event if public feedback resulting from prior alerts has been …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
unfavorable?	❍	❍	❍	❍	❍	❍	❍
neutral?	❍	❍	❍	❍	❍	❍	❍
favorable?	❍	❍	❍	❍	❍	❍	❍

Q14: Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts have been disseminated …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
within 2 minutes of your alert data input?	❍	❍	❍	❍	❍	❍	❍
within 2 to 5 minutes of your alert data input?	❍	❍	❍	❍	❍	❍	❍
within 5 to 10 minutes of your alert data input?	❍	❍	❍	❍	❍	❍	❍
within 10 to 30 minutes of your alert data input?	❍	❍	❍	❍	❍	❍	❍

Q15: Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts sent by WEA have been disseminated …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
with no errors in the message data?	❍	❍	❍	❍	❍	❍	❍
with minor errors in the message data (e.g., errors that do not affect the understandability or content of the message)?	❍	❍	❍	❍	❍	❍	❍
with significant errors in the message data (e.g., errors that affect the understandability or content of the message)?	❍	❍	❍	❍	❍	❍	❍

Q16: Are you likely to use WEA to issue a public alert for a severe and urgent event if you have already used WEA to issue 2 alerts …

	Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
within the past week?	❍	❍	❍	❍	❍	❍	❍
within the past month?	❍	❍	❍	❍	❍	❍	❍
within the past year?	❍	❍	❍	❍	❍	❍	❍

Appendix M Mapping of Alert Originator Trust Model Relationships to Survey Questions

A#	Driver	⇒	Responder	Method	Qualtrics ID	Q#	Question
A1	Urgency	⇒	Appropriate	delta	S1Q7_1	1	Do you think WEA would be an appropriate tool to issue a public alert for an event that requires public action within 10 minutes?
					S1Q7_2	2	Do you think WEA would be an appropriate tool to issue a public alert for an event that requires public action within 30 minutes?
					S1Q7_3	3	Do you think WEA would be an appropriate tool to issue a public alert for an event that requires public action within 60 minutes?
					S1Q7_4	4	Do you think WEA would be an appropriate tool to issue a public alert for an event that requires public action within 2 hours?
A2	Severity	⇒	Appropriate	delta	S1Q7_1	5	Do you think WEA would be an appropriate tool to issue a public alert for an event that poses extraordinary threat to life?
					S1Q7_2	6	Do you think WEA would be an appropriate tool to issue a public alert for an event that poses significant threat to life?
					S1Q7_3	7	Do you think WEA would be an appropriate tool to issue a public alert for an event that poses possible threat to life?
					S1Q7_4	8	Do you think WEA would be an appropriate tool to issue a public alert for an event that poses extraordinary threat to property?
					S1Q7_5	9	Do you think WEA would be an appropriate tool to issue a public alert for an event that poses significant threat to property?
					S1Q7_6	10	Do you think WEA would be an appropriate tool to issue a public alert for an event that poses possible threat to property?
A3	Certainty	⇒	Appropriate	delta	S3Q7_1	11	Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event that is 30% likely to occur?
					S3Q7_2	12	Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event that is 50% likely to occur?
					S3Q7_3	13	Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event that is 70% likely to occur?
					S3Q7_4	14	Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event that is 90% likely to occur?

A#	Driver	⇒	Responder	Method	Qualtrics ID	Q#	Question
A4	Geographic breadth	⇒	Appropriate	delta	S1Q8_1	15	Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event where 30% of the alert recipients are in the hazard zone and 70% are outside the zone?
					S1Q8_2	16	Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event where 50% of the alert recipients are in the hazard zone and 50% are outside the zone?
					S1Q8_3	17	Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event where 70% of the alert recipients are in the hazard zone and 30% are outside the zone?
					S1Q8_4	18	Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event where 90% of the alert recipients are in the hazard zone and 10% are outside the zone?
A5	Time of day	⇒	Appropriate	delta	S1Q8_1	19	Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event that occurs at 10:30 AM?
					S1Q8_2	20	Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event that occurs at 6:30 PM?
					S1Q8_3	21	Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event that occurs at 2:30 AM?

A#	Driver ⇒ Responder	Me-thod	Qual-trics ID	Q#	Question
A6	Responsibility ⇒ Appropriate	delta	S3Q8_1	22	Public alerting responsibility is often distributed across multiple emergency management agencies (EMAs) based on the type of alert and location. However, this distribution is not always foolproof due to unclear alert classifications and overlapping jurisdictions (e.g., the jurisdiction of a municipal EMA is within the jurisdiction of a county EMA within the jurisdiction of a state EMA). In some cases, it may be unclear whether or not your EMA has the primary responsibility for issuing an alert. How likely are you to use WEA for an urgent and severe event in your jurisdiction if you are 50% sure that the responsibility for issuing the alert rests with your EMA and not another?
			S3Q8_2	23	Public alerting responsibility is often distributed across multiple emergency management agencies (EMAs) based on the type of alert and location. However, this distribution is not always foolproof due to unclear alert classifications and overlapping jurisdictions (e.g., the jurisdiction of a municipal EMA is within the jurisdiction of a county EMA within the jurisdiction of a state EMA). In some cases, it may be unclear whether or not your EMA has the primary responsibility for issuing an alert. How likely are you to use WEA for an urgent and severe event in your jurisdiction if you are 70% sure that the responsibility for issuing the alert rests with your EMA and not another?
			S3Q8_3	24	Public alerting responsibility is often distributed across multiple emergency management agencies (EMAs) based on the type of alert and location. However, this distribution is not always foolproof due to unclear alert classifications and overlapping jurisdictions (e.g., the jurisdiction of a municipal EMA is within the jurisdiction of a county EMA within the jurisdiction of a state EMA). In some cases, it may be unclear whether or not your EMA has the primary responsibility for issuing an alert. How likely are you to use WEA for an urgent and severe event in your jurisdiction if you are 90% sure that the responsibility for issuing the alert rests with your EMA and not another?
			S3Q8_4	25	Public alerting responsibility is often distributed across multiple emergency management agencies (EMAs) based on the type of alert and location. However, this distribution is not always foolproof due to unclear alert classifications and overlapping jurisdictions (e.g., the jurisdiction of a municipal EMA is within the jurisdiction of a county EMA within the jurisdiction of a state EMA). In some cases, it may be unclear whether or not your EMA has the primary responsibility for issuing an alert. How likely are you to use WEA for an urgent and severe event in your jurisdiction if you are 99% sure that the responsibility for issuing the alert rests with your EMA and not another?
A7	System readiness ⇒ Availability	delta	S1Q9_1	26	Are you likely to use WEA to issue a public alert for a severe and urgent event if the WEA service is typically unavailable for use 1 hour per week (i.e., 99.4% availability) for maintenance?
			S1Q9_2	27	Are you likely to use WEA to issue a public alert for a severe and urgent event if the WEA service is typically unavailable for use 1 hour per month (i.e., 99.9% availability) for maintenance?
			S1Q9_3	28	Are you likely to use WEA to issue a public alert for a severe and urgent event if the WEA service is typically unavailable for use 1 hour per year (i.e., 99.99% availability) for maintenance?

A#	Driver	⇒	Responder	Me-thod	Qual-trics ID	Q#	Question
A8	System accessibility	⇒	Availability	delta	S2Q9_1		Are you likely to use WEA to issue public alerts if you can access it from several designated facilities (e.g., your Emergency Management office, police precinct stations, etc.) within your jurisdiction, as well as remotely from your mobile device(s)?
					S2Q9_2	30	Are you likely to use WEA to issue public alerts if you can access it only from several designated facilities (e.g., your Emergency Management office, police precinct stations, etc.) within your jurisdiction?
					S2Q9_3	31	Are you likely to use WEA to issue public alerts if you can access it only from your primary office?
A9	System reli-ability	⇒	Availability	delta	S3Q9_1	32	Are you likely to use WEA to issue a public alert for a severe and urgent event if the service successfully transmits 99.9% of the alerts submitted?
					S3Q9_2	33	Are you likely to use WEA to issue a public alert for a severe and urgent event if the service successfully transmits 99% of the alerts submitted?
					S3Q9_3	34	Are you likely to use WEA to issue a public alert for a severe and urgent event if the service successfully transmits 90% of the alerts submitted?
A10	Magnitude of effort	⇒	Availability	delta	S1,2,3 Q10_1	35	Are you likely to use WEA to issue a public alert for a severe and urgent event if the process of creating and issuing an alert takes 5 minutes?
					S1,2,3 Q10_2	36	Are you likely to use WEA to issue a public alert for a severe and urgent event if the process of creating and issuing an alert takes 10 minutes?
					S1,2,3 Q10_3	37	Are you likely to use WEA to issue a public alert for a severe and urgent event if the process of creating and issuing an alert takes 20 minutes?
					S1,2,3 Q10_4	38	Are you likely to use WEA to issue a public alert for a severe and urgent event if the process of creating and issuing an alert takes 40 minutes?
A11	Cross-system integration	⇒	Availability	delta	S1Q11_1	39	Are you likely to use WEA to issue a public alert for a severe and urgent event if the creation and issuance of a WEA alert requires using a system that is independent of other alerting and/or emergency management systems in your office?
					S1Q11_2	40	Are you likely to use WEA to issue a public alert for a severe and urgent event if the creation and issuance of a WEA alert is accomplished within a system that is integrated with other alerting and/or emergency man-agement systems in your office?
A12	Templates	⇒	Availability	delta	S2Q11_1	41	Are you likely to use WEA to issue a public alert for a severe and urgent event if your message creation pro-cess includes the use of templates to assist you in rapidly creating an accurate alert?
					S2Q11_2	42	Are you likely to use WEA to issue a public alert for a severe and urgent event if your message creation pro-cess does not include the use of templates to assist you in rapidly creating an accurate alert?

A#	Driver	⇒	Responder	Me-thod	Qual-trics ID	Q#	Question
A13	Skills/ competen-cies	⇒	Availability	delta	S3Q11_1	43	Are you likely to use WEA to issue a public alert if you have received extensive training (e.g. 40 hours) on the use of the WEA service?
					S3Q11_2	44	Are you likely to use WEA to issue a public alert if you have received adequate training (e.g., 16 hours) on the use of the WEA service?
					S3Q11_3	45	Are you likely to use WEA to issue a public alert if you have received minimal training (e.g., 4 hours) on the use of the WEA service?
A14	Understand-ing	⇒	Availability	delta	S1Q12_1	46	Are you likely to use WEA to issue a public alert if you believe you have a thorough understanding of the principles and applications of the WEA service?
					S1Q12_2	47	Are you likely to use WEA to issue a public alert if you believe you have a moderate understanding of the principles and applications of the WEA service?
					S1Q12_3	48	Are you likely to use WEA to issue a public alert if you believe you have minimal understanding of the princi-ples and applications of the WEA service?
A15	Practice	⇒	Availability	delta	S2Q12_1	49	Are you likely to use WEA to issue a public alert if opportunities to practice the skills needed to use the WEA service are frequent (e.g., twice per week)?
					S2Q12_2	50	Are you likely to use WEA to issue a public alert if opportunities to practice the skills needed to use the WEA service are occasional (e.g., twice per month)?
					S2Q12_3	51	Are you likely to use WEA to issue a public alert if opportunities to practice the skills needed to use the WEA service are rare (e.g., twice per year)?
A16	Security	⇒	Availability	delta	S3Q12_1	52	Are you likely to use WEA if you are aware of no cyber attacks (e.g., spoofing, tampering, denial of service) on the WEA service reported by any WEA users within the past 12 months?
					S3Q12_2	53	Are you likely to use WEA if you are aware of unsuccessful cyber attacks (e.g., failed attempts at spoofing, tampering, denial of service) on the WEA service reported by any WEA users within the past 12 months?
					S3Q12_3	54	Are you likely to use WEA if you are aware of successful cyber attacks (e.g., spoofing, tampering, denial of service) on the WEA service reported by other WEA users within the past 12 months?
					S3Q12_4	55	Are you likely to use WEA if you are aware of successful cyber attacks (e.g., spoofing, tampering, denial of service) on the WEA service reported by your agency within the past 12 months?

A#	Driver	⇒	Responder	Me-thod	Qualtrics ID	Q#	Question
A17	Real-time system feedback	⇒	Effectiveness	delta	S1Q13_1	56	Would you be confident that the WEA service had delivered your alert if you received no response from the WEA service regarding the status of your alert from IPAWS-OPEN?
					S1Q13_2	57	Would you be confident that the WEA service had delivered your alert if you received a response from the WEA service indicating that your message had been received by IPAWS-OPEN?
					S1Q13_3	58	Would you be confident that the WEA service had delivered your alert if you received a response from the WEA service indicating that your message had been received and accepted by IPAWS-OPEN?
					S1Q13_4	59	Would you be confident that the WEA service had delivered your alert if you received a response from the WEA service indicating that your message had been received and accepted by IPAWS-OPEN, and sent to the wireless carriers?
					S1Q13_5	60	Would you be confident that the WEA service had delivered your alert if you received a response from the WEA service indicating that your message had been received and accepted by IPAWS-OPEN, sent to the wireless carriers, and transmitted by the wireless carriers?
A18	Historical system feedback	⇒	Effectiveness	delta	S2Q13_1	61	Are you likely to use WEA to issue a public alert if you have been unable to verify timely and accurate transmission of prior alerts by the WEA service?
					S2Q13_2	62	Are you likely to use WEA to issue a public alert if you have verified timely and accurate transmission of prior alerts by the WEA service?
					S2Q13_3	63	Are you likely to use WEA to issue a public alert if you have verified that prior alerts have not been transmit-ted in a timely and accurate manner?
A19	Public feedback history	⇒	Effectiveness	delta	S3Q13_1	64	Are you likely to use WEA to issue a public alert for a severe and urgent event if public feedback resulting from prior alerts has been unfavorable?
					S3Q13_2	65	Are you likely to use WEA to issue a public alert for a severe and urgent event if public feedback resulting from prior alerts has been neutral?
					S3Q13_3	66	Are you likely to use WEA to issue a public alert for a severe and urgent event if public feedback resulting from prior alerts has been favorable?
A20	After-action review data	⇒	Effectiveness	delta	S1Q14_1	67	Are you likely to use WEA to issue a public alert for a severe and urgent event if findings of internal After Action Reviews of prior alerts have been unfavorable?
					S1Q14_2	68	Are you likely to use WEA to issue a public alert for a severe and urgent event if findings of internal After Action Reviews of prior alerts have been neutral?
					S1Q14_3	69	Are you likely to use WEA to issue a public alert for a severe and urgent event if findings of internal After Action Reviews of prior alerts have been favorable?

A#	Driver	⇒	Responder	Me-thod	Qualtrics ID	Q#	Question
A21	Timeliness of dissemina-tion	⇒	Effectiveness	delta	S1Q15_1, S2,3Q14_1	70	Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts have been disseminated within 2 minutes of your alert data input?
					S1Q15_2, S2,3Q14_2	71	Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts have been disseminated within 2 to 5 minutes of your alert data input?
					S1Q15_3, S2,3Q14_3	72	Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts have been disseminated within 5 to 10 minutes of your alert data input?
					S1Q15_4, S2,3Q14_4	73	Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts have been disseminated within 10 to 30 minutes of your alert data input?
A22	Message under-standability	⇒	Effectiveness	delta	S2Q15_1	74	Are you likely to use WEA to issue a public alert for a severe and urgent event if you are able to issue only “standardized’ messages developed by the WEA service based on your CAP inputs?
					S2Q15_2	75	Are you likely to use WEA to issue a public alert for a severe and urgent event if you can craft any mes-sage of your choosing with a maximum size of 90 characters?
					S2Q15_3	76	Are you likely to use WEA to issue a public alert for a severe and urgent event if you can craft any mes-sage of your choosing with a maximum size of 180 characters?
					S2Q15_4	77	Are you likely to use WEA to issue a public alert for a severe and urgent event if you can craft any mes-sage of your choosing with a maximum size of 270 characters?
A23	Message accuracy	⇒	Effectiveness	delta	S3Q15_1	78	Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts sent by WEA have been disseminated with no errors in the message data?
					S3Q15_2	79	Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts sent by WEA have been disseminated with minor errors in the message data (e.g., errors that do not affect the under-standability of content of the message)?
					S3Q15_3	80	Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts sent by WEA have been disseminated with significant errors in the message data (errors that affect the understandability or content of the message)?
A24	Location accuracy	⇒	Effectiveness	delta	S1Q16_1	81	Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts sent by WEA have been disseminated to a geographic area other than the one specified?
					S1Q16_2	82	Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts sent by WEA have been disseminated to the specified geographic area, and also to some adjacent geographic areas?
					S1Q16_3	83	Are you likely to use WEA to issue a public alert for a severe and urgent event if prior alerts sent by WEA have been disseminated to only a portion of the specified geographic area?

A#	Driver ⇒ Responder	Me-thod	Qualtrics ID	Q#	Question
A25	Public awareness /outreach ⇒ Effectiveness	delta	S2Q16_1	84	Are you likely to use WEA to issue a public alert for a severe and urgent event if the public has been previously informed about WEA and its capabilities via public media such as newspaper reports, TV news, radio news, and/or your own social media channels (e.g., web site, Facebook page, Twitter account)?
			S2Q16_2	85	Are you likely to use WEA to issue a public alert for a severe and urgent event if the public has not been previously informed about WEA and its capabilities via public media such as newspaper reports, TV news, radio news, and/or your own social media channels (e.g., web site, Facebook page, Twitter account)?
A26	Alert frequency ⇒ Effectiveness	delta	S3Q16_1	86	Are you likely to use WEA to issue a public alert for a severe and urgent event if you have already used WEA to issue 2 alerts within the past week?
			S3Q16_2	87	Are you likely to use WEA to issue a public alert for a severe and urgent event if you have already used WEA to issue 2 alerts within the past month?
			S3Q16_3	88	Are you likely to use WEA to issue a public alert for a severe and urgent event if you have already used WEA to issue 2 alerts within the past year?

Appendix N Descriptive Statistical Results for Public Surveys

Table 6 portrays the results of the original survey ordinal response. The variable is the Qualtrics question identifier. The last digit of the variable name distinguishes which of the three surveys the question is from.

Table 6: Results of the Original Survey Ordinal Responses

Variable	*N*	*N**	Min	Q1	Mdn	Q3	Max
Q5_1	77	57	1.000	4.000	5.000	6.000	7.000
Q6_1	78	0	1.000	5.000	5.500	6.000	7.000
Q7_1	78	0	1.000	4.000	5.000	6.000	7.000
Q8_1	78	0	1.000	3.000	4.000	6.000	7.000
Q9_1	78	0	1.000	4.000	5.500	7.000	7.000
Q10_1	78	0	1.000	2.000	3.000	5.000	7.000
Q11_1	76	2	1.000	5.000	6.000	6.750	7.000
Q12_1	76	2	1.000	4.250	5.000	6.000	7.000
Q13_1	76	2	1.000	2.000	3.500	4.750	7.000
Q14_1	76	2	1.000	4.000	5.000	6.000	7.000
Q15_1	76	2	1.000	4.000	5.000	6.000	7.000
Q16_1	76	2	1.000	2.000	3.000	4.000	7.000
Q17_1	76	2	1.000	3.250	5.000	6.000	7.000
Q18_1	76	2	1.000	3.000	5.000	6.000	7.000
Q19_1	75	3	1.000	3.000	5.000	6.000	7.000
Q20_1	75	3	1.000	3.000	5.000	6.000	7.000
Q21_1	76	2	1.000	3.000	5.000	6.000	7.000
Q22_1	76	2	1.000	4.000	5.000	6.000	7.000
Q23_1	76	2	1.000	2.000	3.000	5.000	7.000
Q5_2	106	29	1.000	1.000	2.000	3.000	6.000
Q6_2	105	1	1.000	4.000	5.000	6.000	7.000
Q7_2	106	0	1.000	3.000	5.000	6.000	7.000
Q8_2	104	2	1.000	3.000	4.000	5.000	7.000
Q9_2	104	2	1.000	4.000	5.000	6.000	7.000
Q10_2	104	2	1.000	5.000	6.000	7.000	7.000
Q11_2	103	3	1.000	5.000	5.000	6.000	7.000
Q12_2	104	2	1.000	4.000	5.000	6.000	7.000
Q13_2	101	5	1.000	2.000	3.000	4.000	7.000
Q14_2	102	4	1.000	4.000	5.000	6.000	7.000
Q15_2	100	6	1.000	5.000	6.000	6.000	7.000
Q16_2	100	6	1.000	4.000	5.000	6.000	7.000
Q17_2	99	7	1.000	4.000	5.000	6.000	7.000
Q18_2	98	8	1.000	3.000	4.000	6.000	7.000
Q19_2	99	7	1.000	2.000	3.000	4.000	7.000
Q20_2	99	7	1.000	5.000	6.000	6.000	7.000
Q21_2	98	8	1.000	3.000	4.000	5.000	6.000
Q22_2	98	8	1.000	4.000	5.000	6.000	7.000
Q23_2	97	9	1.000	4.000	4.000	6.000	7.000
Q24_2	97	9	1.000	2.000	3.000	3.500	7.000
Q5_3	98	36	1.000	3.000	5.000	6.000	7.000

Variable	*N*	*N**	Min	Q1	Mdn	Q3	Max
Q6_3	96	2	1.000	4.000	5.000	6.000	7.000
Q7_3	90	8	1.000	4.000	5.000	6.000	7.000
Q8_3	96	2	1.000	3.000	4.000	5.000	7.000
Q9_3	95	3	1.000	3.000	4.000	5.000	7.000
Q10_3	95	3	1.000	5.000	6.000	6.000	7.000
Q11_3	95	3	1.000	5.000	6.000	6.000	7.000
Q12_3	94	4	1.000	4.000	5.000	6.000	7.000
Q13_3	95	3	1.000	3.000	5.000	6.000	7.000
Q14_3	95	3	1.000	5.000	5.000	6.000	7.000
Q15_3	95	3	1.000	2.000	4.000	5.000	7.000
Q16_3	94	4	1.000	2.000	3.000	4.000	6.000
Q17_3	94	4	1.000	2.000	3.000	4.000	7.000
Q18_3	94	4	1.000	2.000	3.000	4.000	7.000
Q19_3	95	3	1.000	3.000	5.000	6.000	7.000
Q20_3	95	3	1.000	2.000	2.000	4.000	7.000
Q21_3	95	3	1.000	4.000	5.000	6.000	7.000
Q22_3	95	3	1.000	3.000	3.000	5.000	7.000
Q23_3	95	3	1.000	2.000	3.000	3.000	7.000

Appendix O Comparative Analysis of Paired Questions for Public Surveys

Table 7: Paired t *for CQ10_2 and CQ10_3*

	N	***M***	***SD***	***SEM***
CQ10_2	67	78.96	23.09	2.82
CQ10_3	67	76.12	19.99	2.44
Difference	67	2.84	30.36	3.71

95% upper bound for mean difference: 9.02.
t Test of mean difference = 0 (vs. < 0): *t* = 0.76, *p* = .776.

Table 8: Paired t *for CQ11_1 and CQ10_2*

	N	***M***	***SD***	***SEM***
CQ11_1	62	74.11	25.17	3.20
CQ10_2	62	80.08	21.45	2.72
Difference	62	–5.97	32.40	4.11

95% upper bound for mean difference: 0.90.
t Test of mean difference = 0 (vs. < 0): *t* = –1.45, *p* = .076.

Table 9: Paired t *for CQ11_1 and CQ10_3*

	N	***M***	***SD***	***SEM***
CQ11_1	64	71.33	24.74	3.09
CQ10_3	64	77.89	18.64	2.33
Difference	64	–6.56	31.10	3.89

95% upper bound for mean difference: –0.07.
t Test of mean difference = 0 (vs. < 0): *t* = –1.69, *p* = .048.

Table 10: Paired t *for CQ13_3 and CQ14_1*

	N	***M***	***SD***	***SEM***
CQ13_3	64	61.29	23.90	2.99
CQ14_1	64	62.50	27.11	3.39
Difference	64	–1.21	40.65	5.08

95% upper bound for mean difference: 7.27.
t Test of mean difference = 0 (vs. < 0): *t* = –0.24, *p* = .406.

Table 11: Paired t *for CQ21_1 and CQ22_2*

	N	***M***	***SD***	***SEM***
CQ21_1	62	59.44	31.71	4.03
CQ22_2	62	71.45	27.52	3.50
Difference	62	–12.02	40.81	5.18

95% upper bound for mean difference: –3.36.
t Test of mean difference = 0 (vs. < 0): *t* = –2.32, *p* = .012.

Table 12: Paired t *for CQ6_3 and CQ7_1*

	N	***M***	***SD***	***SEM***
CQ6_3	68	59.19	25.95	3.15
CQ7_1	68	67.68	26.57	3.22
Difference	68	–8.49	32.54	3.95

95% CI for mean difference: (–16.37, –0.62).
t Test of mean difference = 0 (vs. not = 0): *t* = –2.15, *p* = .035.

Table 13: Paired t *for CQ6_3 and CQ7_2*

	N	*M*	*SD*	*SEM*
CQ6_3	71	58.06	25.45	3.02
CQ7_2	71	65.60	31.19	3.70
Difference	71	–7.54	37.39	4.44

95% CI for mean difference: (–16.39, 1.32).
t Test of mean difference = 0 (vs. not = 0): *t* = –1.70, *p* = .094.

Table 14: Paired t *for CQ7_1 and CQ7_2*

	N	*M*	*SD*	*SEM*
CQ7_1	65	66.88	27.73	3.44
CQ7_2	65	68.31	30.76	3.81
Difference	65	–1.42	42.35	5.25

95% CI for mean difference: (–11.92, 9.07).
t Test of mean difference = 0 (vs. not = 0): *t* = –0.27, *p* = .787.

Table 15: Paired t *for CQ8_3 and CQ21_3*

	N	*M*	*SD*	*SEM*
CQ8_3	95	52.47	29.03	2.98
CQ21_3	95	62.05	24.70	2.53
Difference	95	–9.58	28.15	2.89

95% upper bound for mean difference: –4.78.
t Test of mean difference = 0 (vs. < 0): *t* = –3.32, *p* = .001.

Table 16: Paired t *for CQ21_1 and CQ12_3*

	N	*M*	*SD*	*SEM*
CQ21_1	63	56.23	31.55	3.97
CQ12_3	63	69.48	23.18	2.92
Difference	63	–13.25	38.23	4.82

95% upper bound for mean difference: –5.21.
t Test of mean difference = 0 (vs. < 0): *t* = –2.75, *p* = .004.

Table 17: Paired t *for CQ14_2 and CQ14_3*

	N	*M*	*SD*	*SEM*
CQ14_2	66	64.70	23.74	2.92
CQ14_3	66	70.68	22.74	2.80
Difference	66	–5.98	33.04	4.07

95% upper bound for mean difference: 0.80.
t Test of mean difference = 0 (vs. < 0): *t* = –1.47, *p* = .073.

Table 18: Paired t *for CQ21_1 and CQ22_1*

	N	*M*	*SD*	*SEM*
CQ21_1	76	59.67	30.96	3.55
CQ22_1	76	68.22	29.78	3.42
Difference	76	–8.55	21.03	2.41

95% upper bound for mean difference: –4.53.
t Test of mean difference = 0 (vs. < 0): *t* = –3.54, *p* = .000.

Table 19: Paired t *for CQ6_2 and CQ6_1*

	N	*M*	*SD*	*SEM*
CQ6_2	64	69.49	27.99	3.50
CQ6_1	64	71.84	26.10	3.26
Difference	64	–2.34	39.06	4.88

95% upper bound for mean difference: 5.81.
t Test of mean difference = 0 (vs. < 0): *t* = –0.48, *p* = .316.

Table 20: Paired t *for CQ11_3 and CQ11_2*

	N	***M***	***SD***	***SEM***
CQ11_3	66	78.94	19.71	2.43
CQ11_2	66	74.66	22.85	2.81
Difference	66	4.28	27.92	3.44

95% upper bound for mean difference: 10.02.
t Test of mean difference = 0 (vs. < 0): $t = 1.25$, $p = .891$.

Table 21: Paired t *for CQ12_1 and CQ11_2*

	N	***M***	***SD***	***SEM***
CQ12_1	61	72.05	23.07	2.95
CQ11_2	61	78.07	21.63	2.77
Difference	61	–6.02	33.32	4.27

95% upper bound for mean difference: 1.10.
t Test of mean difference = 0 (vs. < 0): $t = –1.41$, $p = .082$.

Table 22: Paired t *for CQ11_3 and CQ12_1*

	N	***M***	***SD***	***SEM***
CQ11_3	64	79.02	18.89	2.36
CQ12_1	64	70.63	22.49	2.81
Difference	64	8.40	29.75	3.72

95% upper bound for mean difference: 14.61.
t Test of mean difference = 0 (vs. < 0): $t = 2.26$, $p = .986$.

Table 23: Paired t *for CQ12_2 and CQ6_1*

	N	***M***	***SD***	***SEM***
CQ12_2	64	70.47	24.33	3.04
CQ6_1	64	72.42	25.15	3.14
Difference	64	–1.95	36.16	4.52

95% upper bound for mean difference: 5.59.
t Test of mean difference = 0 (vs. < 0): $t = –0.43$, $p = .334$.

Table 24: Paired t *for CQ15_2 and CQ15_1*

	N	***M***	***SD***	***SEM***
CQ15_2	62	79.72	16.49	2.09
CQ15_1	62	72.18	22.95	2.91
Difference	62	7.54	27.64	3.51

95% upper bound for mean difference: 13.40.
t Test of mean difference = 0 (vs. < 0): $t = 2.15$, $p = .982$.

Table 25: Paired t *for CQ9_2 and CQ9_1*

	N	***M***	***SD***	***SEM***
CQ9_2	64	64.96	30.50	3.81
CQ9_1	64	70.16	28.95	3.62
Difference	64	–5.20	42.94	5.37

95% upper bound for mean difference: 3.77.
t Test of mean difference = 0 (vs. < 0): $t = –0.97$, $p = .168$.

Table 26: Paired t *for CQ10_1 and CQ9_3*

	N	***M***	***SD***	***SEM***
CQ10_1	66	42.20	31.97	3.93
CQ9_3	66	47.61	26.95	3.32
Difference	66	–5.42	43.86	5.40

95% upper bound for mean difference: 3.59.
t Test of mean difference = 0 (vs. < 0): $t = –1.00$, $p = .160$.

Appendix P Descriptive Statistical Results for Alert Originator Surveys

In Table 27, the variable is the question identifier from the Qualtrics survey. For example, S1Q5_1 represents Survey 1, Question 5, Subquestion 1.

Table 27: Results of the Original Survey Ordinal Responses

Variable	*N*	*N**	Min	Q1	Mdn	Q3	Max
S1Q5_1	18	0	34	1,184	59,000	555,000	5,000,000
S1Q5_2	14	4	0	50	25,000	142,500	10,000,000
S1Q6	18	0	1.0000	2.0000	2.0000	2.0000	2.0000
S1Q7_1	18	0	4.000	5.000	7.000	7.000	7.000
S1Q7_2	17	1	4.000	5.000	6.000	7.000	7.000
S1Q7_3	17	1	2.000	4.500	5.000	7.000	7.000
S1Q7_4	16	2	1.000	4.000	6.500	7.000	7.000
S1Q8_1	16	2	1.000	4.000	5.500	7.000	7.000
S1Q8_2	16	2	2.000	5.000	6.500	7.000	7.000
S1Q8_3	16	2	3.000	6.000	7.000	7.000	7.000
S1Q8_4	16	2	4.000	7.000	7.000	7.000	7.000
S1Q9_1	16	2	4.000	5.000	7.000	7.000	7.000
S1Q9_2	16	2	4.000	6.000	7.000	7.000	7.000
S1Q9_3	16	2	4.000	6.000	7.000	7.000	7.000
S1Q10_1	16	2	4.000	6.000	7.000	7.000	7.000
S1Q10_2	16	2	3.000	4.000	5.500	6.000	7.000
S1Q10_3	16	2	1.000	2.250	4.000	5.750	6.000
S1Q10_4	16	2	1.000	1.000	3.000	4.750	6.000
S1Q11_1	16	2	4.000	4.000	5.500	6.000	7.000
S1Q11_2	16	2	4.000	6.000	7.000	7.000	7.000
S1Q12_1	16	2	4.000	6.000	7.000	7.000	7.000
S1Q12_2	15	3	1.000	4.000	5.000	6.000	7.000
S1Q12_3	16	2	1.000	2.250	3.500	5.000	7.000
S1Q13_1	16	2	1.000	1.000	3.500	4.000	6.000
S1Q13_2	16	2	1.000	3.250	4.000	5.000	6.000
S1Q13_3	16	2	1.000	4.000	5.000	6.000	7.000
S1Q13_4	16	2	1.000	4.250	6.000	7.000	7.000
S1Q13_5	16	2	4.000	6.000	7.000	7.000	7.000
S1Q14_1	16	2	1.000	3.000	4.000	5.000	7.000
S1Q14_2	16	2	4.000	4.000	5.000	6.000	7.000
S1Q14_3	15	3	4.000	6.000	6.000	7.000	7.000
S1Q15_1	16	2	4.000	5.250	7.000	7.000	7.000
S1Q15_2	16	2	4.000	5.000	6.500	7.000	7.000
S1Q15_3	16	2	3.000	5.000	5.500	6.000	7.000
S1Q15_4	16	2	2.000	3.250	4.500	5.000	7.000
S1Q16_1	16	2	1.000	3.000	4.000	4.000	7.000
S1Q16_2	16	2	4.000	4.000	5.500	6.000	7.000
S1Q16_3	16	2	2.000	4.000	4.000	6.750	7.000
S2Q5_1	30	1	86	3,825	12,000	208,750	1,547,000
S2Q5_2	23	8	0	100	900	20,000	100,000
S2Q6	27	4	1.0000	2.0000	2.0000	2.0000	2.0000

Variable	*N*	*N**	Min	Q1	Mdn	Q3	Max
S2Q7_1	31	0	5.0000	7.0000	7.0000	7.0000	7.0000
S2Q7_2	31	0	4.000	6.000	7.000	7.000	7.000
S2Q7_3	31	0	1.000	4.000	5.000	6.000	7.000
S2Q7_4	31	0	1.000	5.000	7.000	7.000	7.000
S2Q7_5	31	0	1.000	5.000	5.000	7.000	7.000
S2Q7_6	31	0	1.000	3.000	5.000	6.000	7.000
S2Q8_1	31	0	3.000	7.000	7.000	7.000	7.000
S2Q8_2	31	0	3.000	7.000	7.000	7.000	7.000
S2Q8_3	31	0	1.000	6.000	7.000	7.000	7.000
S2Q9_1	31	0	4.000	6.000	7.000	7.000	7.000
S2Q9_2	31	0	1.000	6.000	7.000	7.000	7.000
S2Q9_3	31	0	1.000	4.000	6.000	7.000	7.000
S2Q10_1	30	1	4.000	6.000	7.000	7.000	7.000
S2Q10_2	31	0	2.000	5.000	5.000	6.000	7.000
S2Q10_3	31	0	1.000	2.000	4.000	5.000	7.000
S2Q10_4	31	0	1.000	1.000	3.000	4.000	7.000
S2Q11_1	31	0	1.000	6.000	7.000	7.000	7.000
S2Q11_2	31	0	1.000	4.000	6.000	7.000	7.000
S2Q12_1	31	0	1.000	5.000	6.000	7.000	7.000
S2Q12_2	31	0	1.000	5.000	6.000	7.000	7.000
S2Q12_3	31	0	1.000	4.000	4.000	6.000	7.000
S2Q13_1	31	0	1.000	3.000	4.000	6.000	7.000
S2Q13_2	31	0	1.000	6.000	7.000	7.000	7.000
S2Q13_3	31	0	1.000	2.000	4.000	6.000	7.000
S2Q14_1	31	0	1.000	6.000	7.000	7.000	7.000
S2Q14_2	31	0	1.000	6.000	7.000	7.000	7.000
S2Q14_3	31	0	1.000	4.000	6.000	7.000	7.000
S2Q14_4	31	0	1.000	3.000	5.000	6.000	7.000
S2Q15_1	31	0	1.000	4.000	5.000	6.000	7.000
S2Q15_2	31	0	1.000	5.000	6.000	7.000	7.000
S2Q15_3	31	0	1.000	6.000	7.000	7.000	7.000
S2Q15_4	30	1	1.000	6.000	7.000	7.000	7.000
S2Q16_1	31	0	1.000	6.000	7.000	7.000	7.000
S2Q16_2	31	0	1.000	4.000	6.000	7.000	7.000
S3Q5_1	17	0	1	4,050	225,000	695,000	4,000,000
S3Q5_2	13	4	2	750	3,000	65,000	500,000
S3Q6	17	0	1.0000	2.0000	2.0000	2.0000	2.0000
S3Q7_1	17	0	1.000	3.000	4.000	4.500	7.000
S3Q7_2	17	0	3.000	4.000	5.000	5.500	7.000
S3Q7_3	17	0	4.000	5.500	6.000	6.000	7.000
S3Q7_4	17	0	4.000	6.500	7.000	7.000	7.000
S3Q8_1	16	1	3.000	4.000	5.500	7.000	7.000
S3Q8_2	16	1	4.000	5.000	6.000	7.000	7.000
S3Q8_3	16	1	4.000	6.000	6.500	7.000	7.000
S3Q8_4	17	0	4.000	6.000	7.000	7.000	7.000
S3Q9_1	16	1	5.000	7.000	7.000	7.000	7.000
S3Q9_2	16	1	5.000	6.250	7.000	7.000	7.000
S3Q9_3	17	0	4.000	6.000	7.000	7.000	7.000
S3Q10_1	17	0	5.000	6.500	7.000	7.000	7.000
S3Q10_2	17	0	3.000	5.000	6.000	7.000	7.000

Variable	*N*	*N**	Min	Q1	Mdn	Q3	Max
S3Q10_3	17	0	1.000	3.000	4.000	4.500	6.000
S3Q10_4	16	1	1.000	2.000	3.000	3.750	5.000
S3Q11_1	17	0	3.000	5.500	7.000	7.000	7.000
S3Q11_2	17	0	4.000	6.000	6.000	7.000	7.000
S3Q11_3	17	0	3.000	4.500	5.000	7.000	7.000
S3Q12_1	16	1	4.000	6.000	7.000	7.000	7.000
S3Q12_2	16	1	3.000	6.000	6.000	7.000	7.000
S3Q12_3	16	1	1.000	3.000	5.000	6.000	6.000
S3Q12_4	16	1	1.000	2.000	4.000	5.000	6.000
S3Q13_1	16	1	4.000	5.000	6.000	6.000	7.000
S3Q13_2	16	1	4.000	6.000	6.000	7.000	7.000
S3Q13_3	16	1	5.000	7.000	7.000	7.000	7.000
S3Q14_1	16	1	1.000	4.500	6.500	7.000	7.000
S3Q14_2	16	1	1.000	5.000	6.000	7.000	7.000
S3Q14_3	16	1	3.000	4.250	5.000	6.750	7.000
S3Q14_4	16	1	2.000	3.250	4.500	6.000	7.000
S3Q15_1	16	1	3.000	6.250	7.000	7.000	7.000
S3Q15_2	16	1	4.000	6.000	6.000	7.000	7.000
S3Q15_3	16	1	1.000	2.250	3.500	4.000	6.000
S3Q16_1	16	1	3.000	6.000	7.000	7.000	7.000
S3Q16_2	16	1	3.000	6.250	7.000	7.000	7.000
S3Q16_3	16	1	3.000	7.000	7.000	7.000	7.000

Appendix Q Comparative Analysis of Paired Questions for Alert Originator Surveys

Table 28: Paired t *for S1CQ7_1 and S1CQ7_2*

	N	*M*	*SD*	*SEM*
S1CQ7_1	17	83.68	19.18	4.65
S1CQ7_2	17	84.71	16.58	4.02
Difference	17	−1.03	19.29	4.68

95% CI for mean difference: [−10.94, 8.89].
t Test of mean difference = 0 (vs. not = 0): $t = -0.22$, $p = .829$.

Table 29: Paired t *for S1CQ7_1 and S1CQ7_3*

	N	*M*	*SD*	*SEM*
S1CQ7_1	17	83.68	19.18	4.65
S1CQ7_3	17	76.03	24.92	6.04
Difference	17	7.65	29.65	7.19

95% lower bound for mean difference: −4.91.
t Test of mean difference = 0 (vs. > 0): $t = 1.06$, $p = .152$.

Table 30: Paired t *for S1CQ7_1 and S1CQ7_4*

	N	*M*	*SD*	*SEM*
S1CQ7_1	16	84.53	19.48	4.87
S1CQ7_4	16	70.78	33.67	8.42
Difference	16	13.8	40.8	10.2

95% lower bound for mean difference: −4.1.
t Test of mean difference = 0 (vs. > 0): $t = 1.35$, $p = .099$.

Table 31: Paired t *for S1CQ8_1 and S1CQ8_2*

	N	*M*	*SD*	*SEM*
S1CQ8_1	16	72.66	29.26	7.32
S1CQ8_2	16	80.94	24.71	6.18
Difference	16	−8.28	11.32	2.83

95% upper bound for mean difference: −3.32.
t Test of mean difference = 0 (vs. < 0): $t = -2.93$, $p = .005$.

Table 32: Paired t *for S1CQ8_1 and S1CQ8_3*

	N	*M*	*SD*	*SEM*
S1CQ8_1	16	72.66	29.26	7.32
S1CQ8_3	16	85.47	21.68	5.42
Difference	16	−12.81	15.62	3.91

95% upper bound for mean difference: −5.97.
t Test of mean difference = 0 (vs. < 0): $t = -3.28$, $p = .003$.

Table 33: Paired t *for S1CQ8_1 and S1CQ8_4*

	N	*M*	*SD*	*SEM*
S1CQ8_1	16	72.66	29.26	7.32
S1CQ8_4	16	93.28	12.03	3.01
Difference	16	−20.63	27.76	6.94

95% upper bound for mean difference: −8.46.
t Test of mean difference = 0 (vs. < 0): $t = -2.97$, $p = .005$.

Table 34: Paired t *for S2CQ8_1 and S2CQ8_2*

	N	***M***	***SD***	***SEM***
S2CQ8_1	31	94.35	12.31	2.21
S2CQ8_2	31	92.90	13.68	2.46
Difference	31	1.452	4.645	0.834

95% CI for mean difference: [−0.252, 3.155].
t Test of mean difference = 0 (vs. not = 0): *t* = 1.74, *p* = .092.

Table 35: Paired t *for S2CQ8_1 and S2CQ8_3*

	N	***M***	***SD***	***SEM***
S2CQ8_1	31	94.35	12.31	2.21
S2CQ8_3	31	81.85	30.61	5.50
Difference	31	12.50	26.92	4.83

95% lower bound for mean difference: 4.29.
t Test of mean difference = 0 (vs. > 0): *t* = 2.59, *p* = .007.

Table 36: Paired t *for S3CQ8_1 and S3CQ8_4*

	N	***M***	***SD***	***SEM***
S3CQ8_1	16	74.38	22.50	5.63
S3CQ8_4	16	87.97	16.56	4.14
Difference	16	−13.59	28.68	7.17

95% upper bound for mean difference: −1.02.
t Test of mean difference = 0 (vs. < 0): *t* = −1.90, *p* = .039.

Table 37: Paired t *for S1CQ9_1 and S1CQ9_3*

	N	***M***	***SD***	***SEM***
S1CQ9_1	16	86.41	15.30	3.83
S1CQ9_3	16	90.94	13.22	3.31
Difference	16	−4.5	38.72	2.18

95% upper bound for mean difference: −0.71.
t Test of mean difference = 0 (vs. < 0): *t* = −2.08, *p* = .028.

Table 38: Paired t *for S2CQ9_1 and S2CQ9_3*

	N	***M***	***SD***	***SEM***
S2CQ9_1	31	89.19	14.99	2.69
S2CQ9_3	31	71.21	33.28	5.98
Difference	31	17.98	31.12	5.59

95% lower bound for mean difference: 8.50.
t Test of mean difference = 0 (vs. > 0): *t* = 3.22, *p* = .002.

Table 39: Paired t *for S3CQ9_1 and S3CQ9_3*

	N	***M***	***SD***	***SEM***
S3CQ9_1	16	93.44	9.48	2.37
S3CQ9_3	16	88.59	16.73	4.18
Difference	16	4.84	12.60	3.15

95% lower bound for mean difference: −0.68.
t Test of mean difference = 0 (vs. > 0): *t* = 1.54, *p* = .072.

Table 40: Paired t *for S3CQ8_1 and S3CQ8_4*

	N	***M***	***SD***	***SEM***
S3CQ8_1	16	74.38	22.50	5.63
S3CQ8_4	16	87.97	16.56	4.14
Difference	16	−13.59	28.68	7.17

95% upper bound for mean difference: −1.02.
t Test of mean difference = 0 (vs. < 0): *t* = −1.90, *p* = .039.

Table 41: Paired t *for S1CQ11_1 and S1CQ11_2*

	N	***M***	***SD***	***SEM***
S1CQ11_1	16	73.75	18.48	4.62
S1CQ11_2	16	90.78	11.93	2.98
Difference	16	−17.03	17.13	4.28

95% upper bound for mean difference: −9.52.
t Test of mean difference = 0 (vs. < 0): $t = -3.98$, $p = .001$.

Table 42: Paired t *for S3CQ11_1 and S3CQ11_3*

	N	***M***	***SD***	***SEM***
S3CQ11_1	17	86.91	20.19	4.90
S3CQ11_3	17	76.47	21.92	5.32
Difference	17	10.44	27.62	6.70

95% lower bound for mean difference: −1.25.
t Test of mean difference = 0 (vs. > 0): $t = 1.56$, $p = .069$.

Table 43: Paired t *for S1CQ12_1 and S1CQ12_3*

	N	***M***	***SD***	***SEM***
S1CQ12_1	16	89.69	13.00	3.25
S1CQ12_3	16	44.69	30.26	7.57
Difference	16	45.00	33.22	8.30

95% lower bound for mean difference: 30.44.
t Test of mean difference = 0 (vs. > 0): $t = 5.42$, $p = .000$.

Table 44: Paired t *for S2CQ12_1 and S2CQ12_3*

	N	***M***	***SD***	***SEM***
S2CQ12_1	31	77.42	29.03	5.21
S2CQ12_3	31	58.39	30.53	5.48
Difference	31	19.03	36.38	6.53

95% lower bound for mean difference: 7.94.
t Test of mean difference = 0 (vs. > 0): $t = 2.91$, $p = .003$.

Table 45: Paired t *for S3CQ12_1 and S3CQ12_4*

	N	***M***	***SD***	***SEM***
S3CQ12_1	16	90.31	13.13	3.28
S3CQ12_4	16	43.59	30.70	7.67
Difference	16	46.72	27.41	6.85

95% lower bound for mean difference: 34.70.
t Test of mean difference = 0 (vs. > 0): $t = 6.82$, $p = .000$.

Table 46: Paired t *for S3CQ13_1 and S3CQ13_2*

	N	***M***	***SD***	***SEM***
S3CQ13_1	16	79.06	14.14	3.53
S3CQ13_2	16	87.81	12.41	3.10
Difference	16	−8.75	12.65	3.16

95% upper bound for mean difference: −3.21.
t Test of mean difference = 0 (vs. < 0): $t = -2.77$, $p = .007$.

Table 47: Paired t *for S2CQ13_3 and S2CQ13_2*

	N	***M***	***SD***	***SEM***
S2CQ13_3	3	146.85	35.46	6.37
S2CQ13_2	31	90.00	17.45	3.13
Difference	31	−43.15	33.20	5.96

95% upper bound for mean difference: −33.02.
t Test of mean difference = 0 (vs. < 0): $t = -7.23$, $p = .000$.

Table 48: Paired t *for S1CQ14_1 and S1CQ14_3*

	N	***M***	***SD***	***SEM***
S1CQ14_1	15	50.00	27.42	7.08
S1CQ14_3	15	87.33	13.93	3.60
Difference	15	−37.33	29.39	7.59

95% upper bound for mean difference: −23.97.
t Test of mean difference = 0 (vs. < 0): *t* = −4.92, *p* = .000.

Table 49: Paired t *for S2CQ15_1 and S2CQ15_4*

	N	***M***	***SD***	***SEM***
S2CQ15_1	30	64.08	23.87	4.36
S2CQ15_4	30	89.92	18.63	3.40
Difference	30	−25.83	21.50	3.93

95% upper bound for mean difference: −19.16.
t Test of mean difference = 0 (vs. < 0): *t* = −6.58, *p* = .000.

Table 50: Paired t *for S3CQ15_1 and S3CQ15_3*

	N	***M***	***SD***	***SEM***
S3CQ15_1	16	89.06	19.79	4.95
S3CQ15_3	16	39.06	25.59	6.40
Difference	16	50.00	35.92	8.98

95% lower bound for mean difference: 34.26.
t Test of mean difference = 0 (vs. > 0): *t* = 5.57, *p* = .000.

Table 51: Paired t *for S1CQ16_1 and S1CQ16_3*

	N	***M***	***SD***	***SEM***
S1CQ16_1	16	47.50	28.91	7.23
S1CQ16_3	16	62.97	27.99	7.00
Difference	16	−15.47	35.49	8.87

95% upper bound for mean difference: 0.08.
t Test of mean difference = 0 (vs. < 0): *t* = −1.74, *p* = .051.

Table 52: Paired t *for S2CQ16_1 and S2CQ16_2*

	N	***M***	***SD***	***SEM***
S2CQ16_1	31	90.08	19.09	3.43
S2CQ16_2	31	74.03	28.17	5.06
Difference	31	16.05	22.55	4.05

95% lower bound for mean difference: 9.17.
t Test of mean difference = 0 (vs. > 0): *t* = 3.96, *p* = .000.

Table 53: Paired t *for S3CQ16_1 and S3CQ16_3*

	N	***M***	***SD***	***SEM***
S3CQ16_1	16	84.84	22.67	5.67
S3CQ16_3	16	92.03	16.89	4.22
Difference	16	−7.19	17.67	4.42

95% upper bound for mean difference: 0.56.
t Test of mean difference = 0 (vs. < 0): *t* = −1.63, *p* = .062.

Table 54: Two-Sample t *Test for S2CQ7_1 vs. S1CQ7_4*

N	*M*	*SD*	*SE*	*M*
S2CQ7_1	31	96.29	5.20	0.93
S1CQ7_4	16	70.8	33.7	8.4

Difference = μ (S2CQ7_1) – μ (S1CQ7_4)
Estimate for difference: 25.51
95% CI for difference: (7.46, 43.56)
t Test of difference = 0 (vs. not =): $t = 3.01$, $p = .009$, $df = 15$

Table 55: Two-Sample t *Test for S2CQ7_1 vs. S2CQ7_6*

N	*M*	*SD*	*SE*	*M*
S2CQ7_1	31	96.29	5.20	0.93
S2CQ7_6	31	61.3	30.4	5.5

Difference = μ (S2CQ7_1) – μ (S2CQ7_6)
Estimate for difference: 35.00
95% CI for difference: (23.69, 46.31)
t Test of difference = 0 (vs. not =): $t = 6.31$, $p = .000$, $df = 31$

Table 56: Two-Sample t *Test for S2CQ7_1 vs. S2CQ7_5*

N	*M*	*SD*	*SE*	*M*
S2CQ7_1	31	96.29	5.20	0.93
S2CQ7_5	31	74.8	24.1	4.3

Difference = μ (S2CQ7_1) – μ (S2CQ7_5)
Estimate for difference: 21.53
95% CI for difference: (12.50, 30.57)
t Test of difference = 0 (vs. not =): $t = 4.85$, $p = .000$, $df = 32$

Table 57: Two-Sample t *Test for S2CQ7_1 vs. S2CQ7_3*

N	*M*	*SD*	*SE*	*M*
S2CQ7_1	31	96.29	5.20	0.93
S2CQ7_3	31	69.0	25.9	4.6

Difference = μ (S2CQ7_1) – μ (S2CQ7_3)
Estimate for difference: 27.26
95% CI for difference: (17.61, 36.91)
t Test of difference = 0 (vs. not =): $t = 5.75$, $p = .000$, $df = 32$

Table 58: Two-Sample t *Test for S2CQ7_1 vs. S2CQ7_2*

N	*M*	*SD*	*SE*	*M*
S2CQ7_1	31	96.29	5.20	0.93
S2CQ7_2	31	91.6	10.8	1.9

Difference = μ (S2CQ7_1) – μ (S2CQ7_2)
Estimate for difference: 4.68
95% CI for difference: (0.34, 9.02)
t Test of difference = 0 (vs. not =): $t = 2.17$, $p = .035$, $df = 43$

Table 59: Two-Sample t *Test for S3CQ7_1 vs. S3CQ7_4*

N	*M*	*SD*	*SE*	*M*
S3CQ7_1	17	48.2	25.6	6.2
S3CQ7_4	17	88.5	18.5	4.5

Difference = μ (S3CQ7_1) – μ (S3CQ7_4)
Estimate for difference: –40.29
95% CI for difference: (–55.99, –24.60)
t Test of difference = 0 (vs. not =): $t = –5.25$, $p = .000$, $df = 29$

Table 60: Two-Sample t *Test for S3CQ7_1 vs. S3CQ7_3*

N	***M***	***SD***	***SE***	***M***
S3CQ7_1	17	48.2	25.6	6.2
S3CQ7_3	17	81.6	16.3	3.9

Difference = μ (S3CQ7_1) − μ (S3CQ7_3)
Estimate for difference: −33.38
95% CI for difference: (−48.50, −18.27)
t Test of difference = 0 (vs. not =): $t = -4.53$, $p = .000$, $df = 27$

Table 61: Two-Sample t *Test for S3CQ7_1 vs. S3CQ7_2*

N	***M***	***SD***	***SE***	***M***
S3CQ7_1	17	48.2	25.6	6.2
S3CQ7_2	17	64.7	21.9	5.3

Difference = μ (S3CQ7_1) − μ (S3CQ7_2)
Estimate for difference: −16.47
95% CI for difference: (−33.14, 0.20)
t Test of difference = 0 (vs. not =): $t = -2.02$, $p = .053$, $df = 31$

Appendix R Alert Originator Survey Graphical Results

Alert Originator Conglomeration

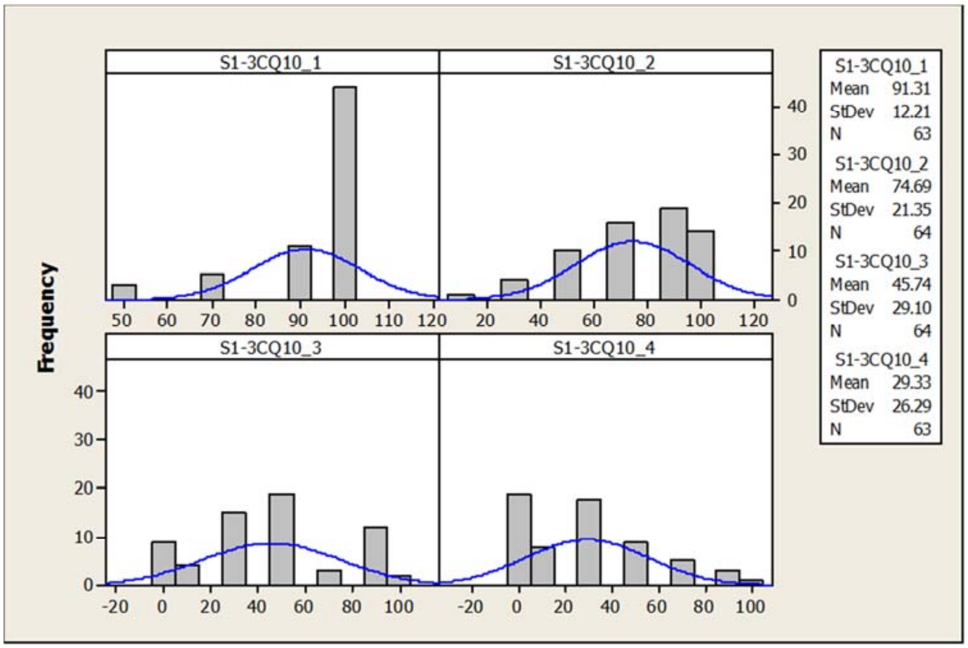

Figure 13: Histogram of S1-3CQ10_1, S1-3CQ10_2, S1-3CQ10_3, and S1-3CQ10_4

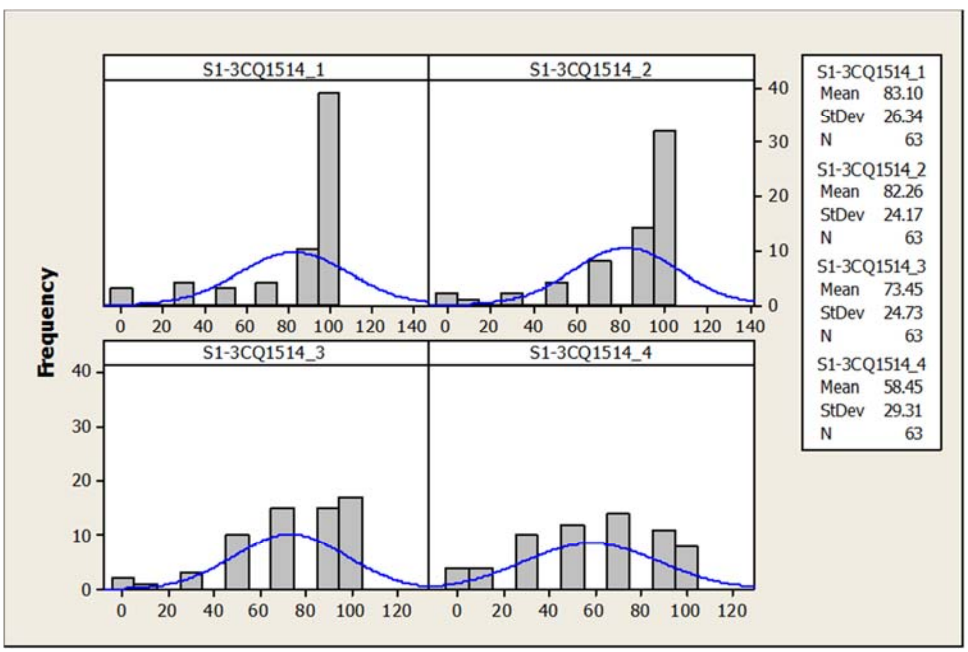

Figure 14: Histogram of S1-3CQ1514_1, S1-CQ1514_2, S1-3CQ1514_3, and S1-3CQ1514_4

Histograms from Alert Originator Survey 1

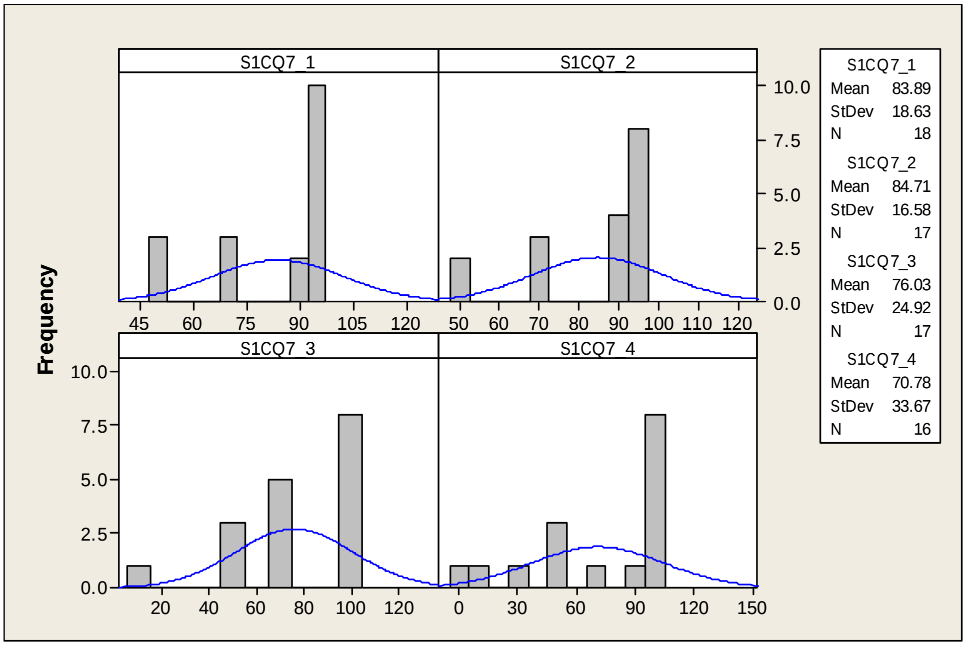

Figure 15: Histogram of S1CQ7_1, S1CQ7_2, S1CQ7_3, and S1CQ7_4

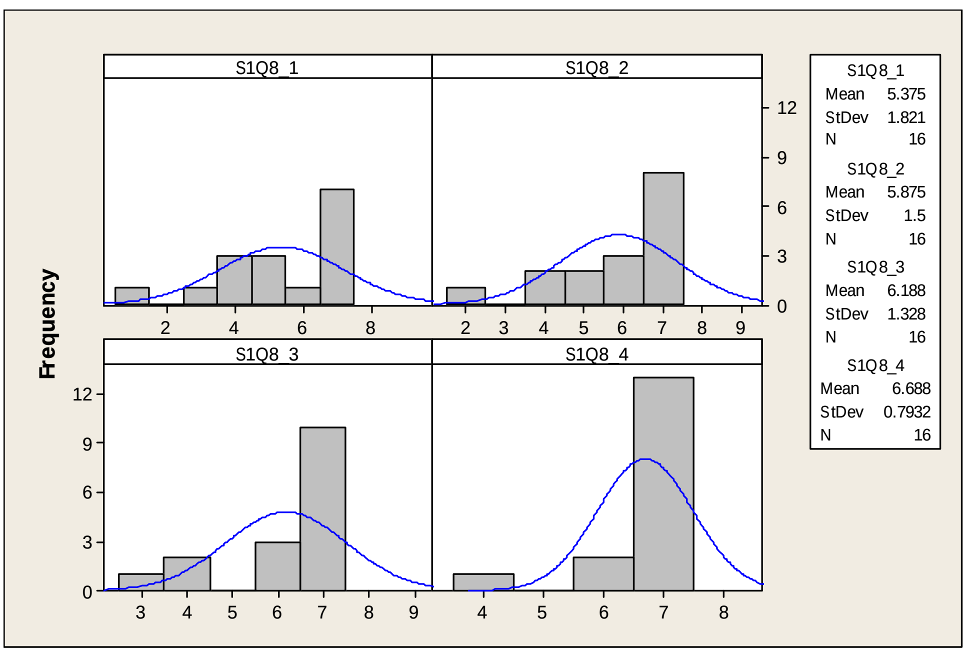

Figure 16: Histogram of S1Q8_1, S1Q8_2, S1Q8_3, and S1Q8_4

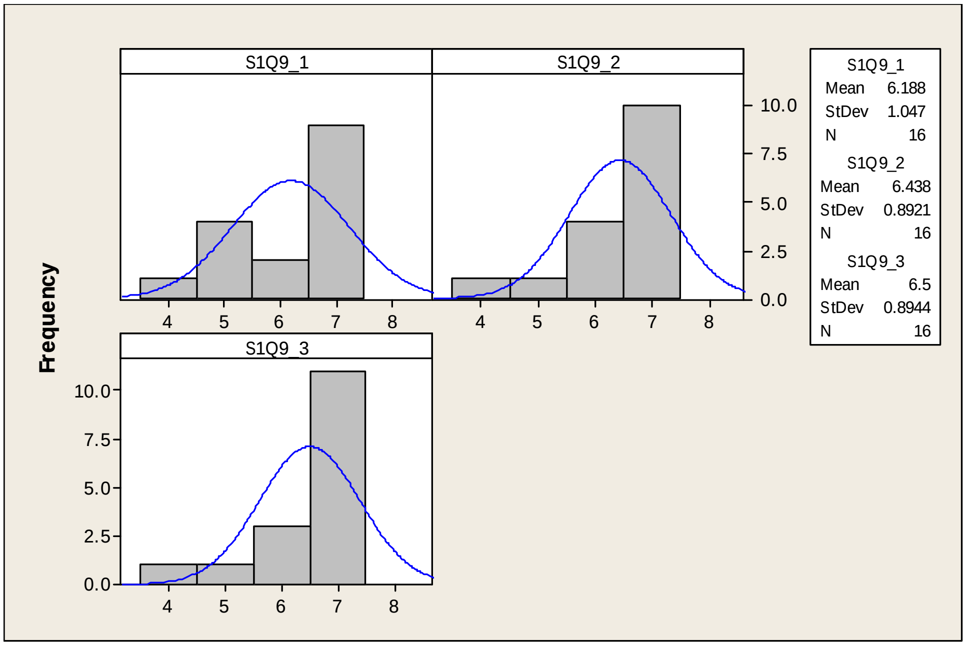

Figure 17: Histogram of S1Q9_1, S1Q9_2, and S1Q9_3

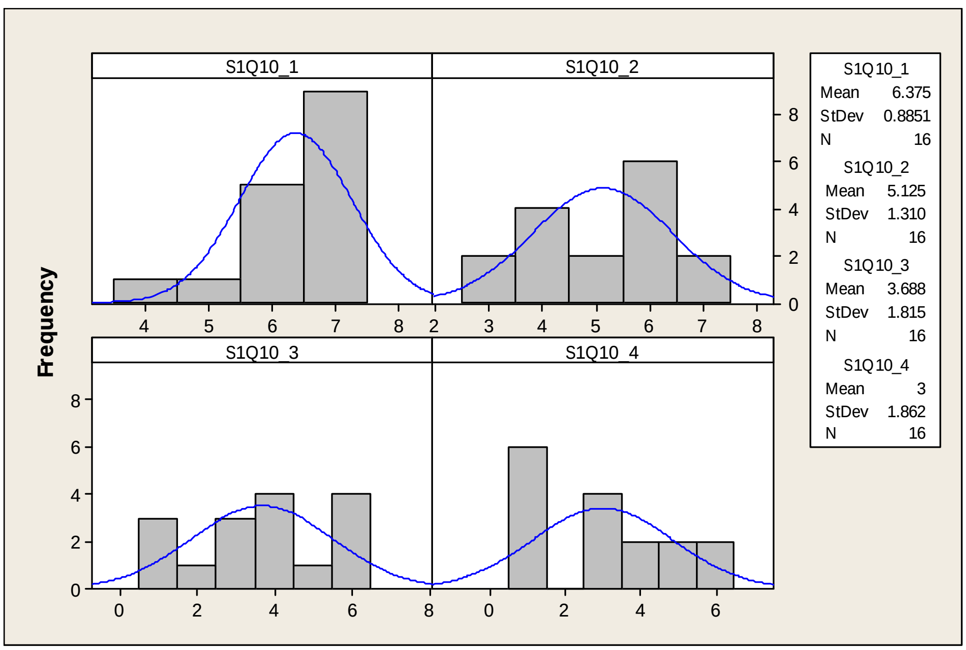

Figure 18: Histogram of S1Q10_1, S1Q10_2, S1Q10_3, and S1Q10_4

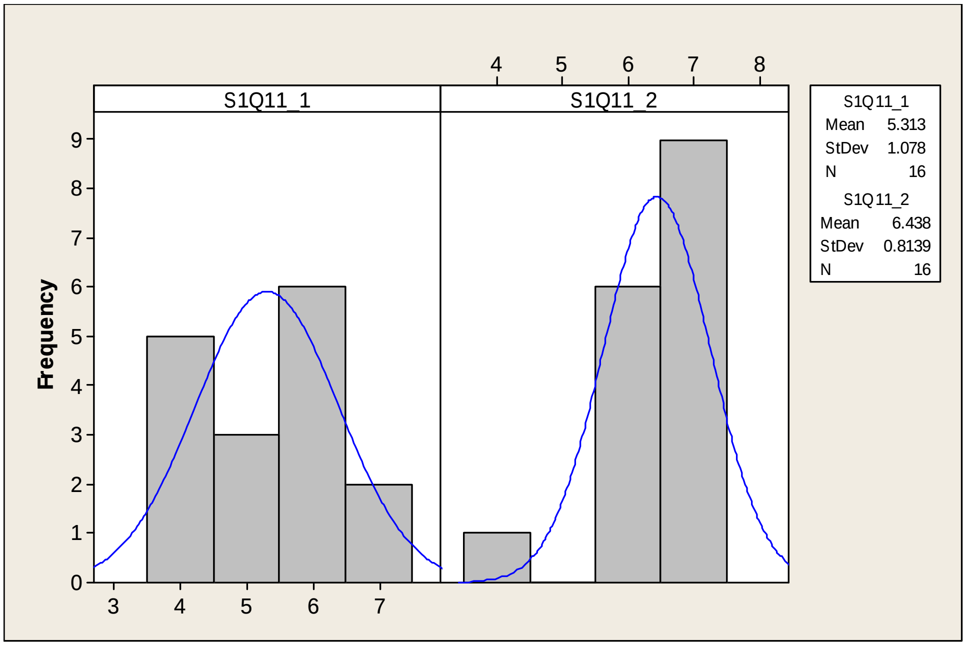

Figure 19: Histogram of S1Q11_1 and S1Q11_2

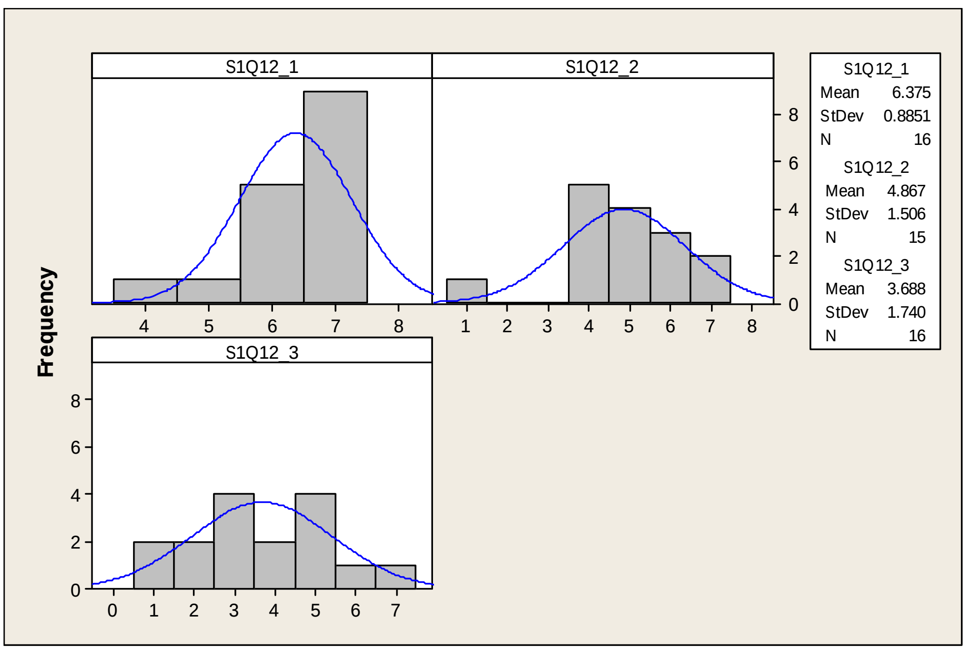

Figure 20: Histogram of S1Q12_1, S1Q12_2, and S1Q12_3

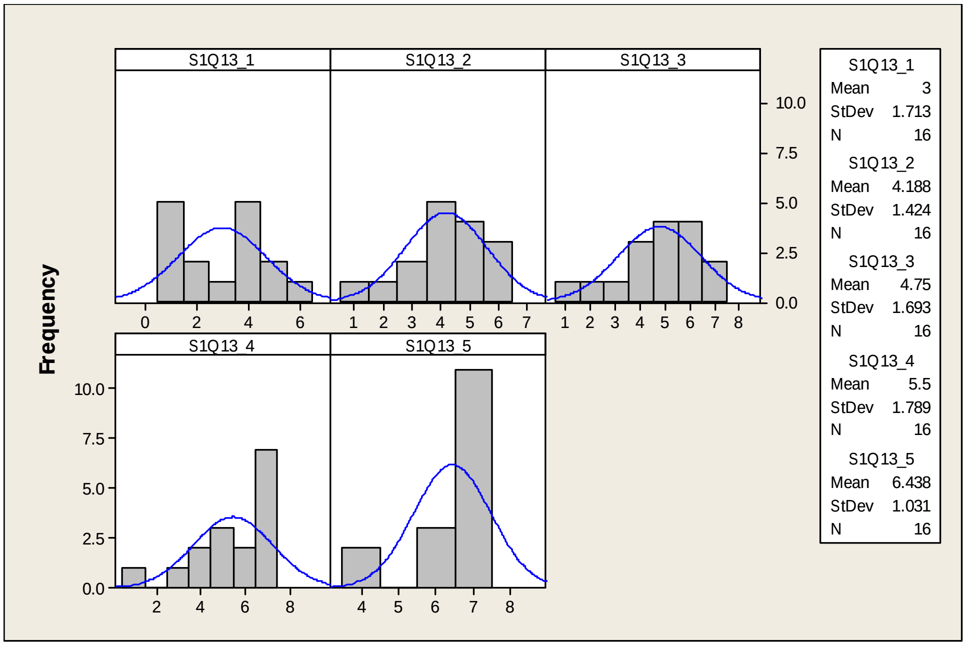

Figure 21: Histogram of S1Q13_1, S1Q13_2, S1Q13_3, S1Q13_4, and S1Q13_5

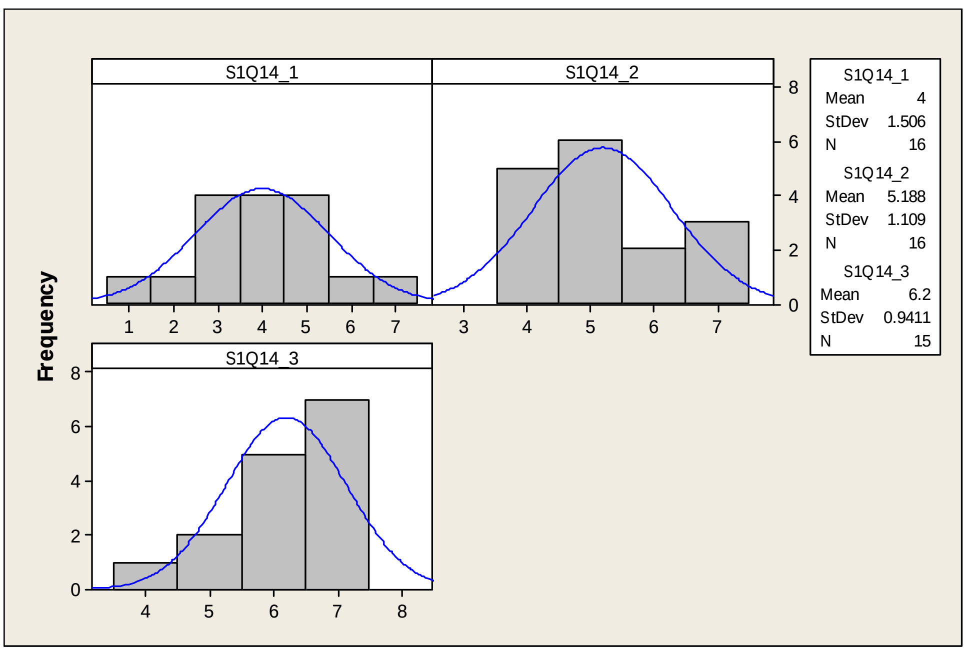

Figure 22: Histogram of S1Q14_1, S1Q14_2, and S1Q14_3

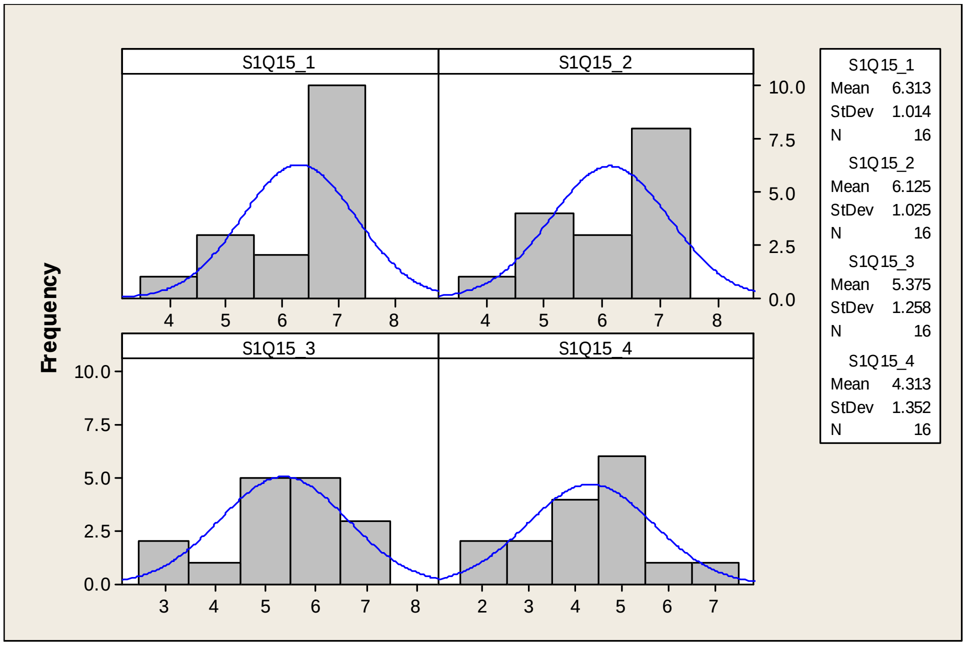

Figure 23: Histogram of S1Q15_1, S1Q15_2, S1Q15_3, and S1Q15_4

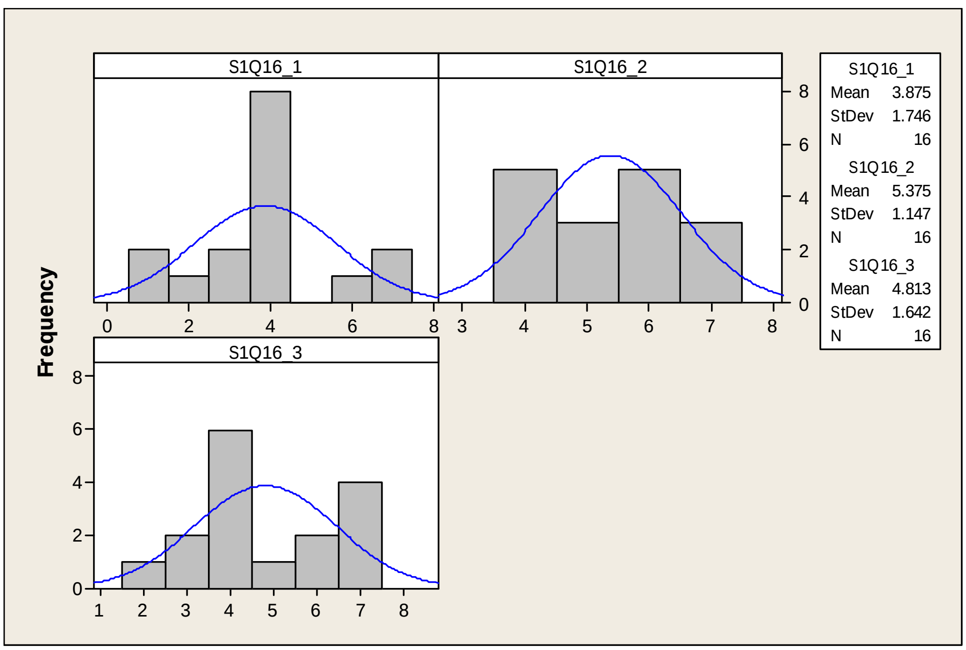

Figure 24: Histogram of S1Q16_1, S1Q16_2, and S1Q16_3

Histograms from Alert Originator Survey 2

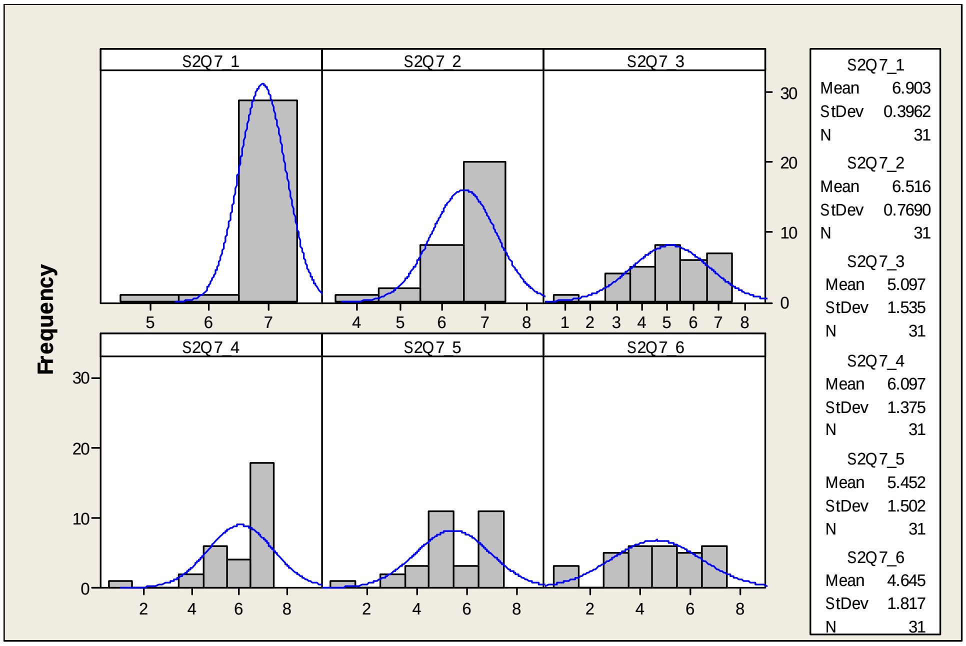

Figure 25: Histogram of S2Q7_1, S2Q7_2, S2Q7_3, S2Q7_4, S2Q7_5, and S2Q7_6

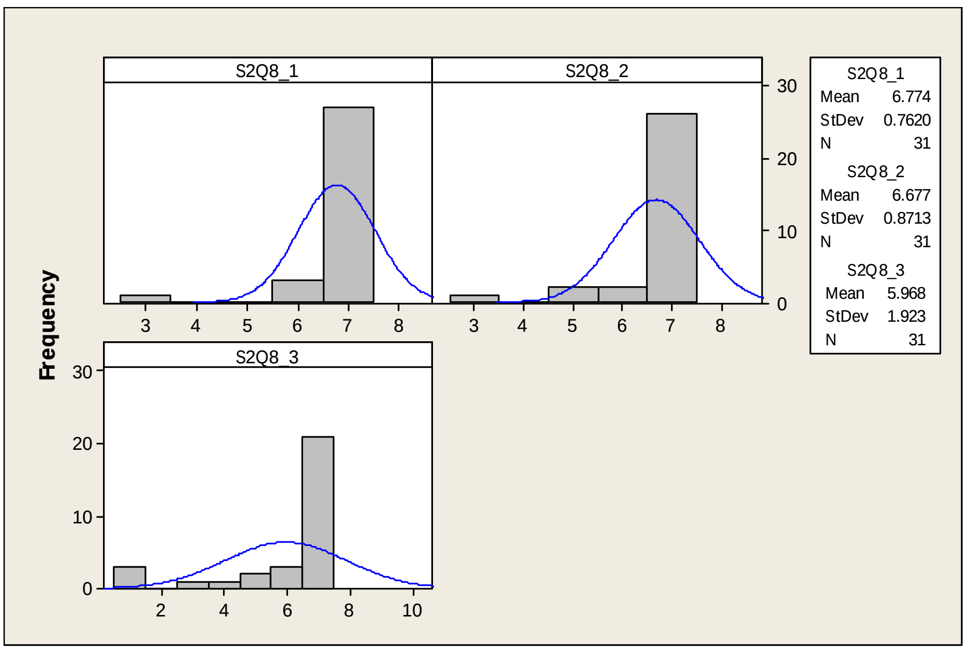

Figure 26: Histogram of S2Q8_1, S2Q8_2, and S2Q8_3

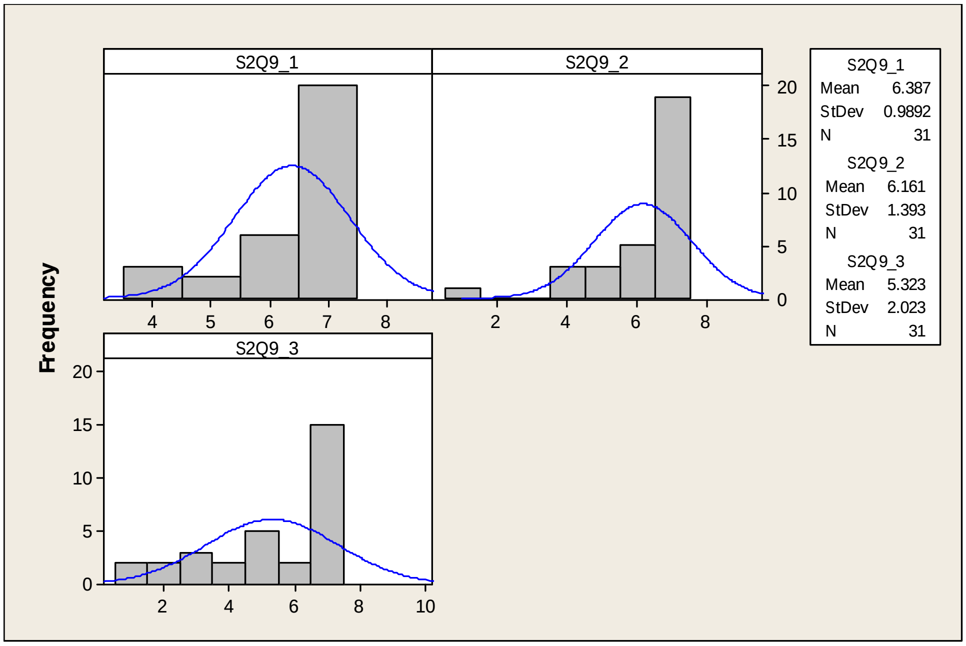

Figure 27: Histogram of S2Q9_1, S2Q9_2, and S2Q9_3

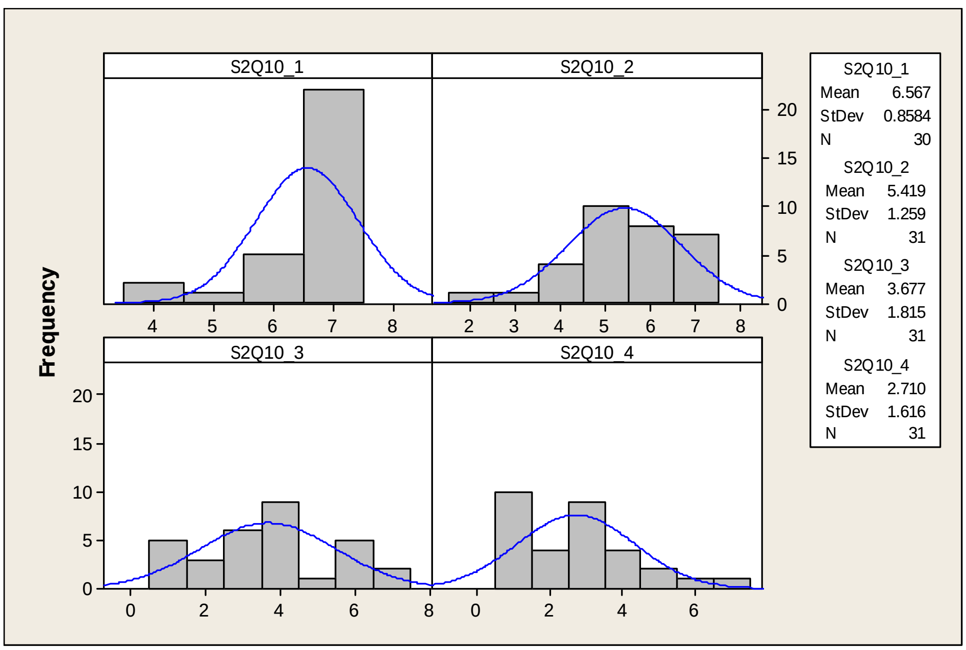

Figure 28: Histogram of S2Q10_1, S2Q10_2, S2Q10_3, and S2Q10_4

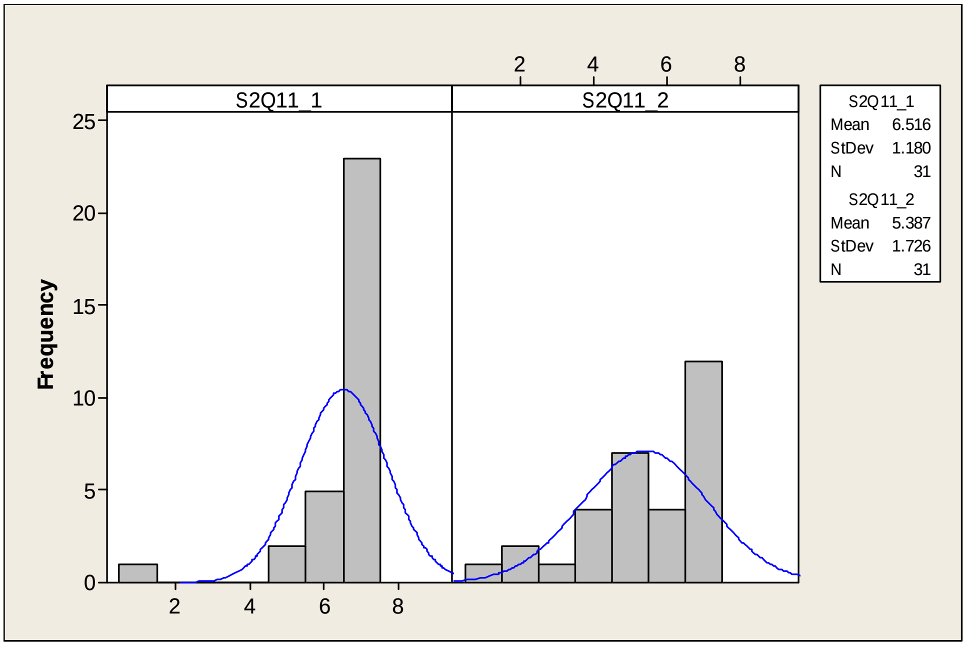

Figure 29: Histogram of S2Q11_1 and S2Q11_2

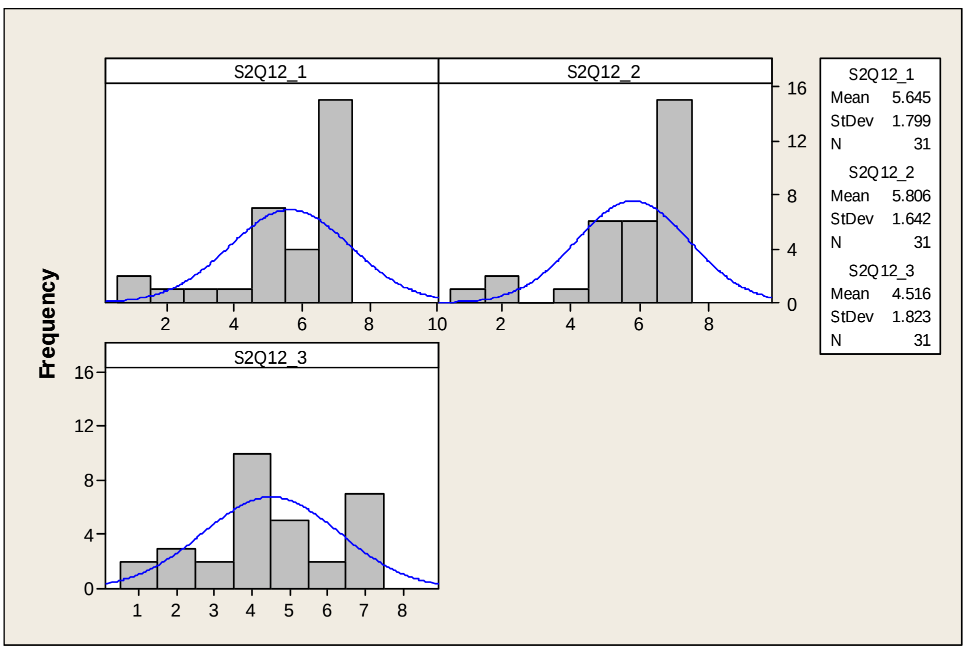

Figure 30: Histogram of S2Q12_1, S2Q12_2, and S2Q12_3

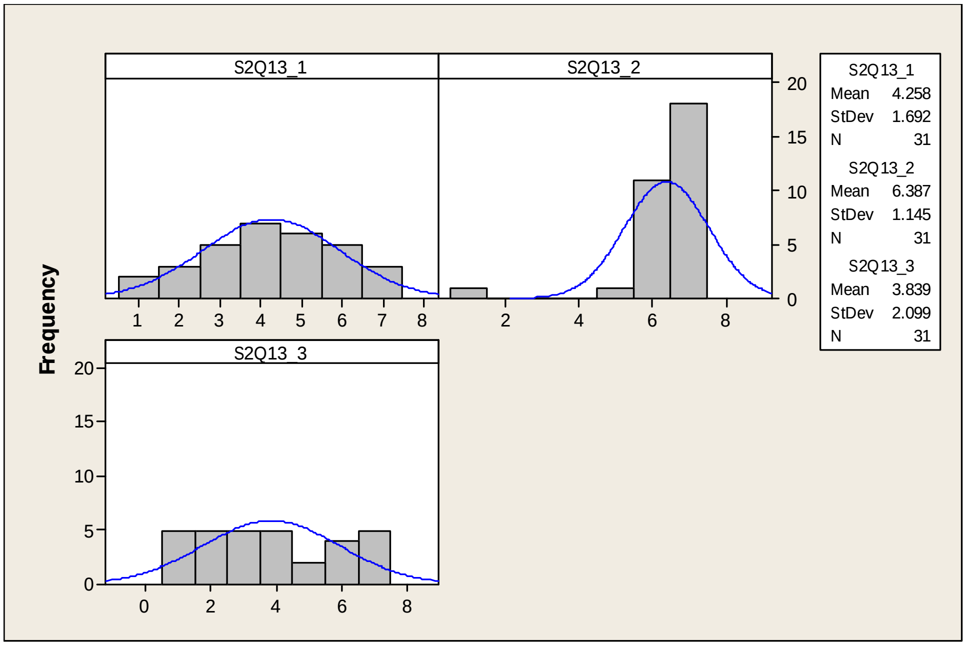

Figure 31: Histogram of S2Q13_1, S2Q13_2, and S2Q13_3

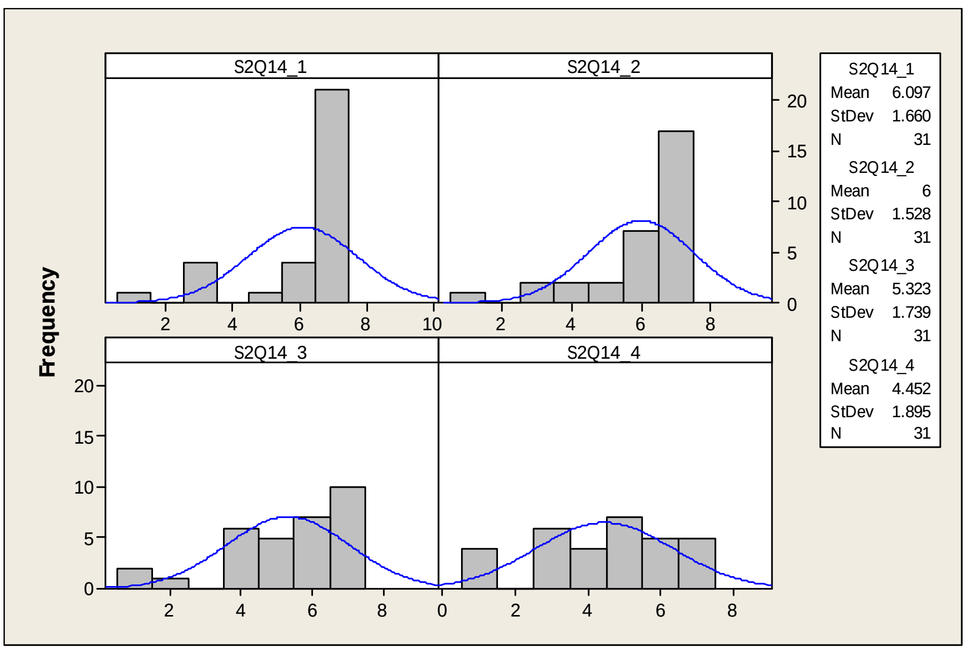

Figure 32: Histogram of S2Q14_1, S2Q14_2, S2Q14_3, and S2Q14_4

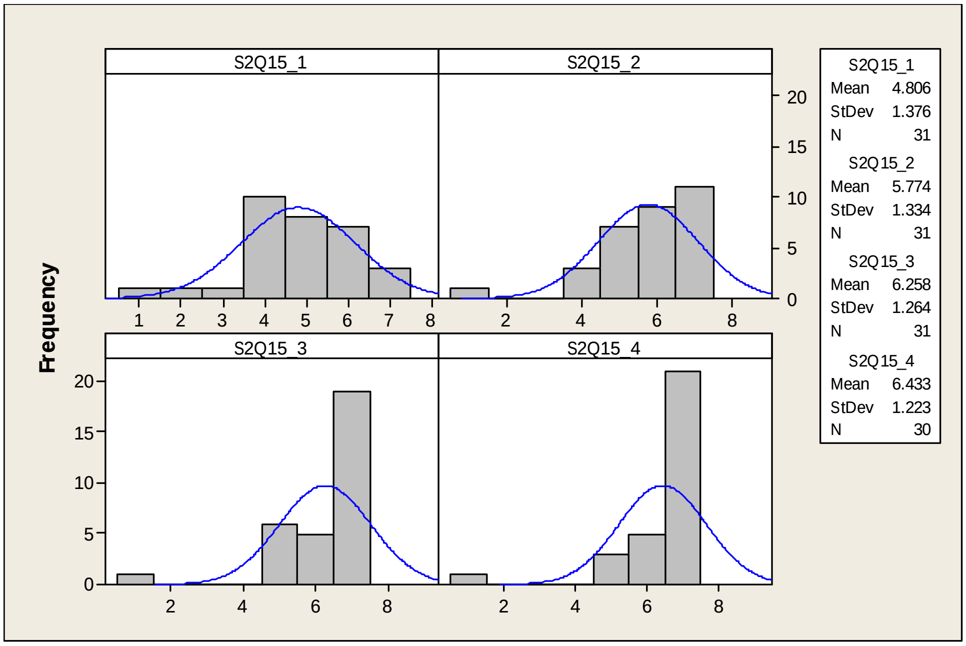

Figure 33: Histogram of S2Q15_1, S2Q15_2, S2Q15_3, and S2Q15_4

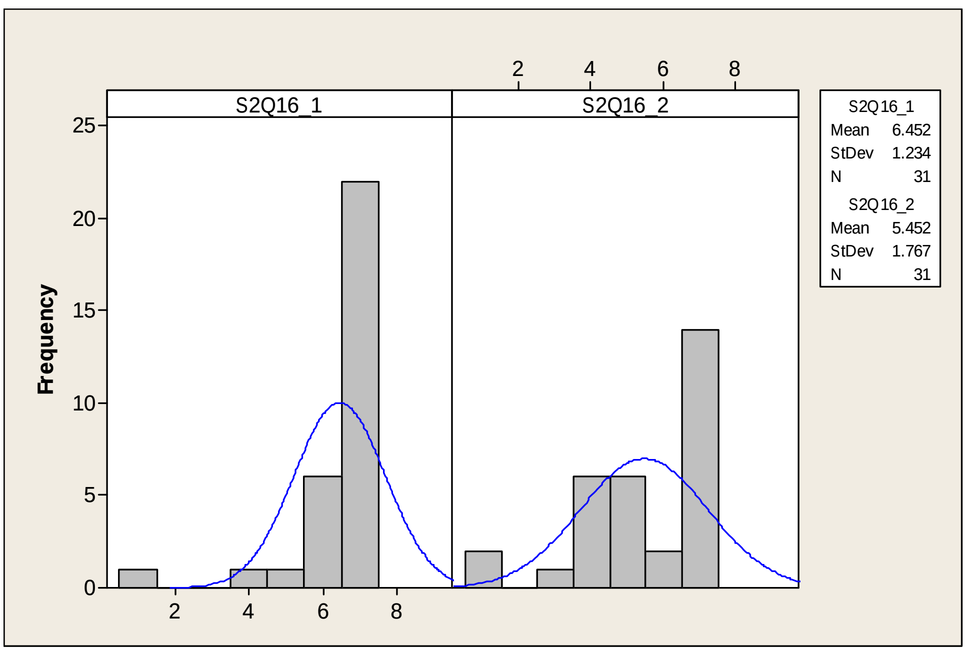

Figure 34: Histogram of S2Q16_1 and S2Q16_2

Histograms from Alert Originator Survey 3

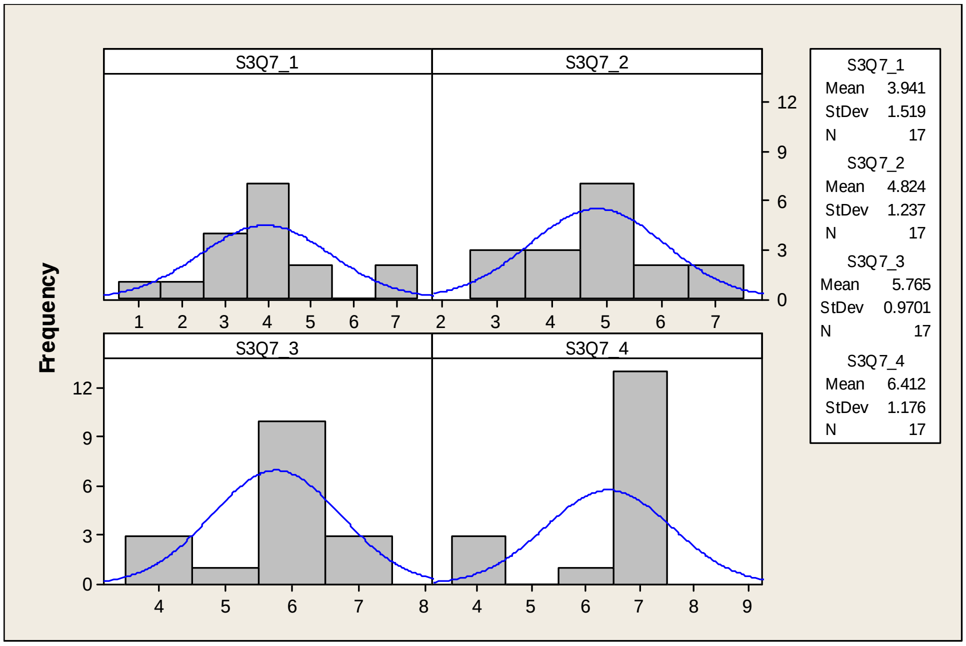

Figure 35: Histogram of S3Q7_1, S3Q7_2, S3Q7_3, and S3Q7_4

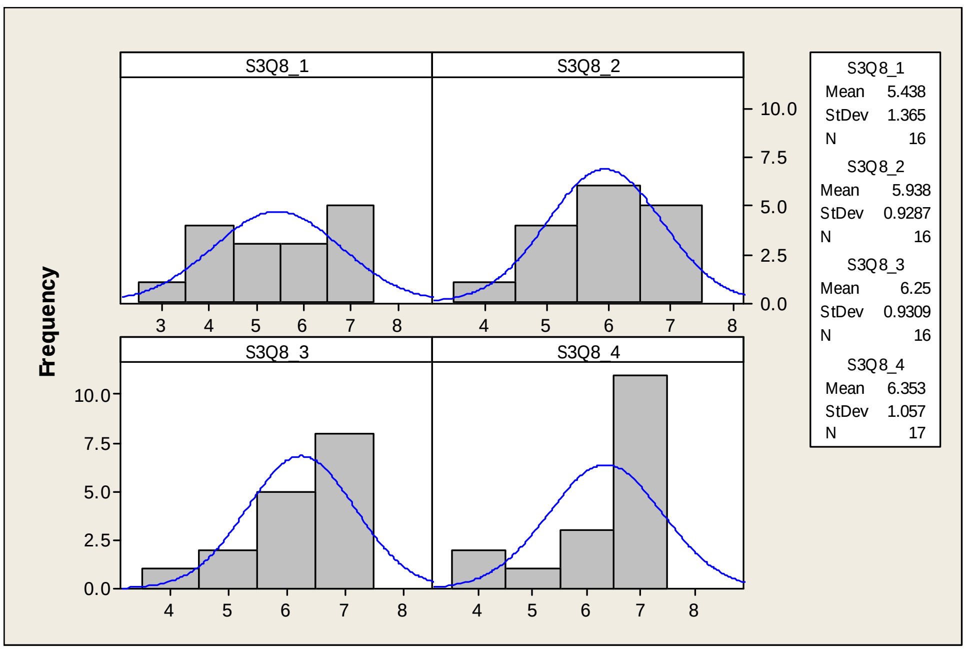

Figure 36: Histogram of S3Q8_1, S3Q8_2, S3Q8_3, and S3Q8_4

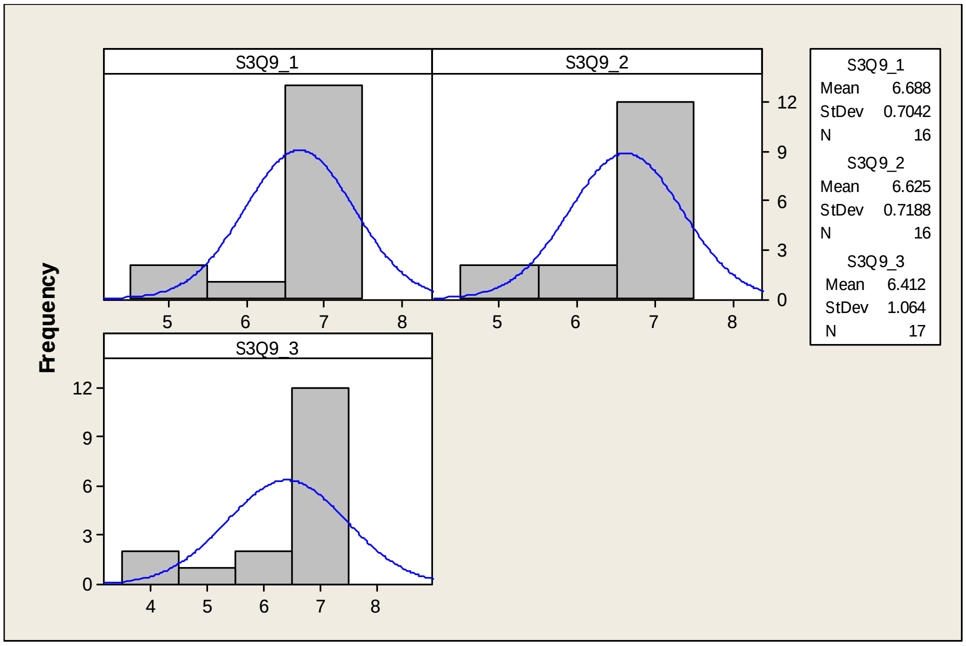

Figure 37: Histogram of S3Q9_1, S3Q9_2, and S3Q9_3

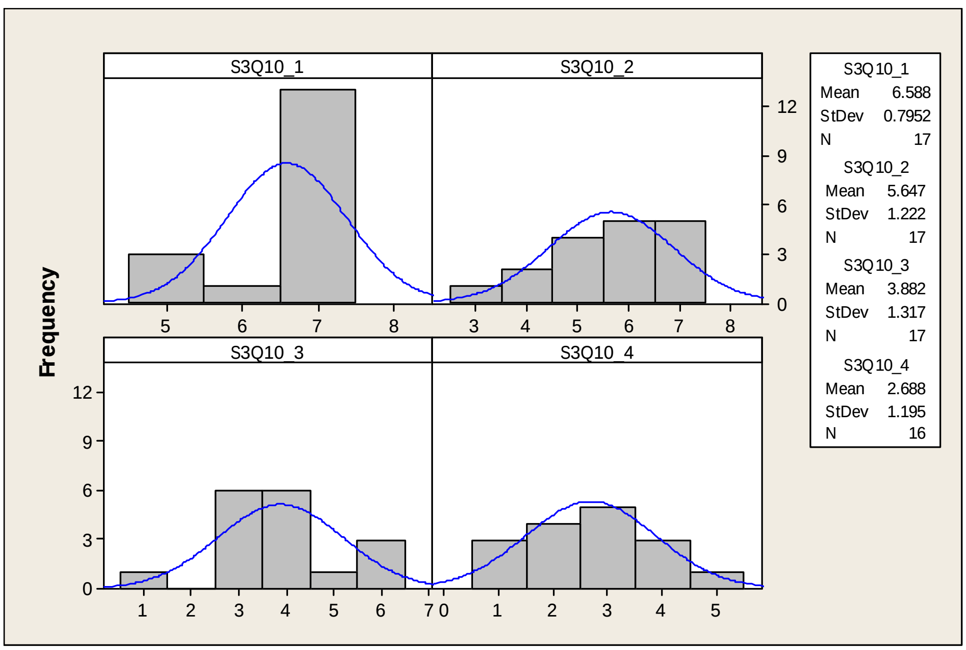

Figure 38: Histogram of S3Q10_1, S3Q10_2, S3Q10_3, and S3Q10_4

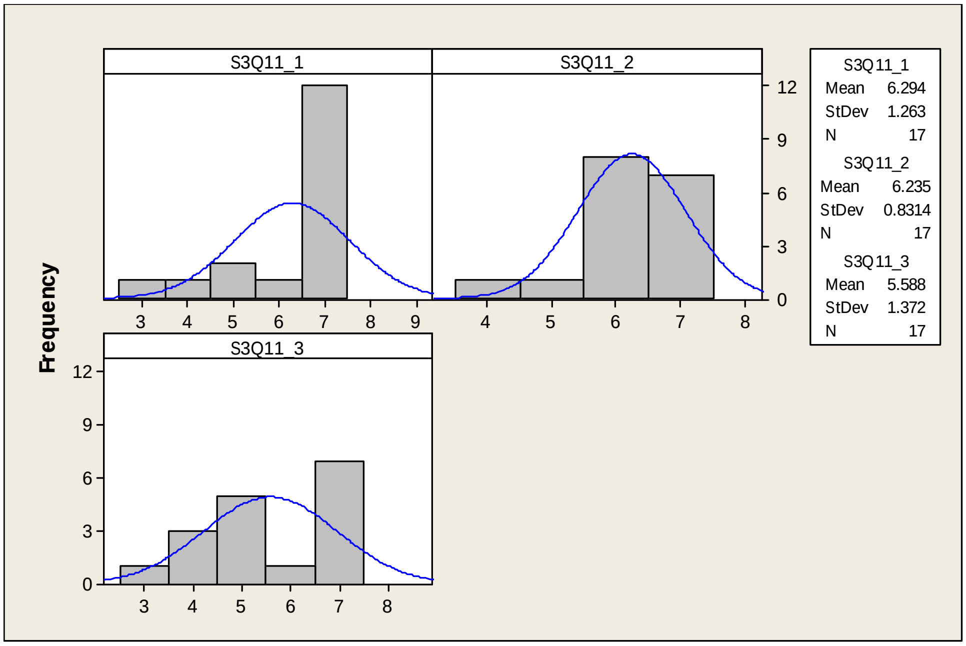

Figure 39: Histogram of S3Q11_1, S3Q11_2, and S3Q11_3

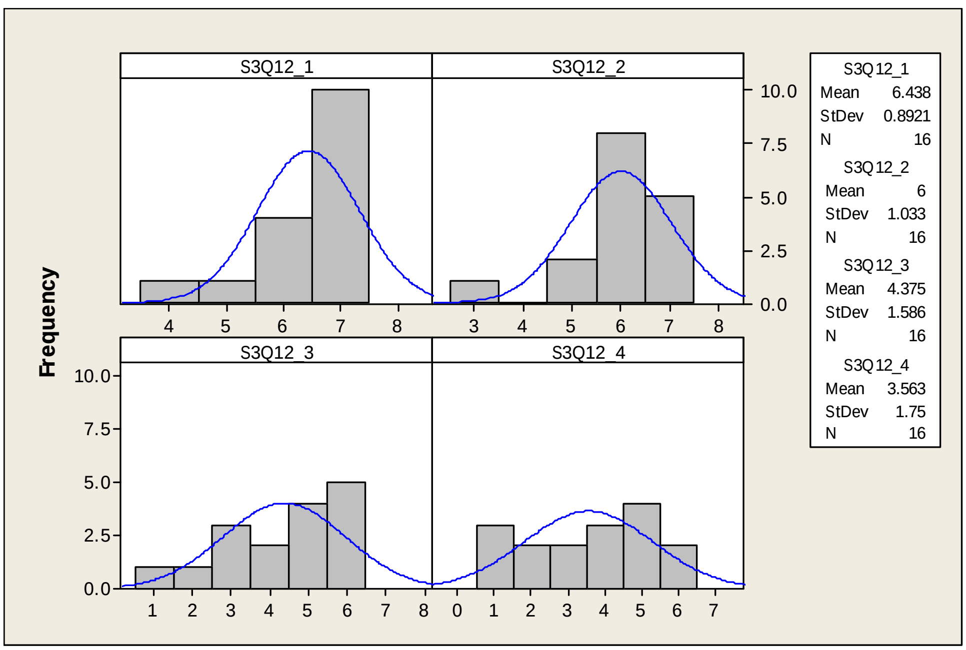

Figure 40: Histogram of S3Q12_1, S3Q12_2, S3Q12_3, and S3Q12_4

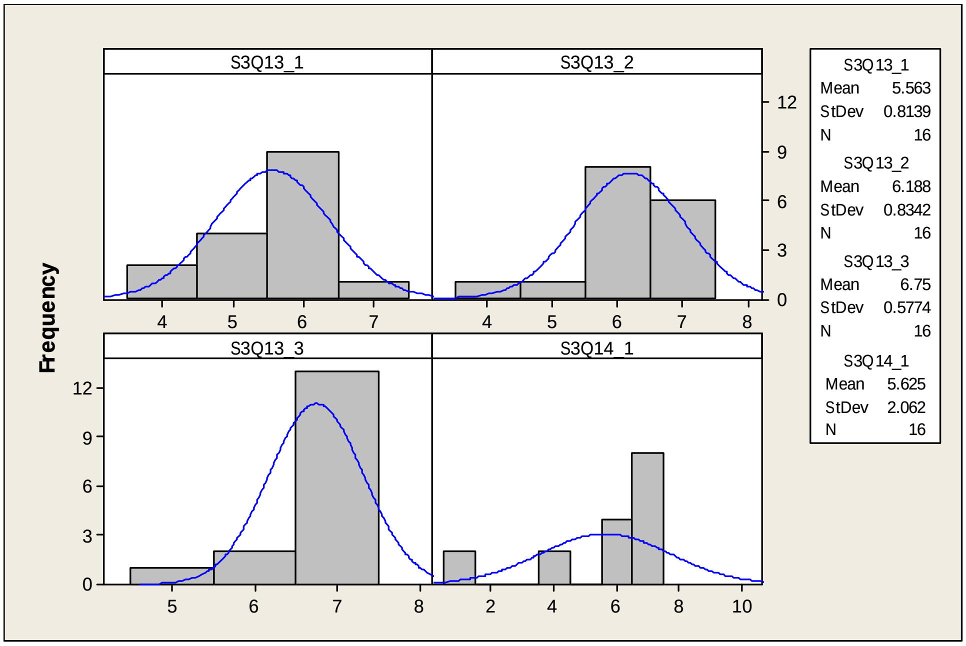

Figure 41: Histogram of S3Q13_1, S3Q13_2, S3Q13_3, and S3Q13_4

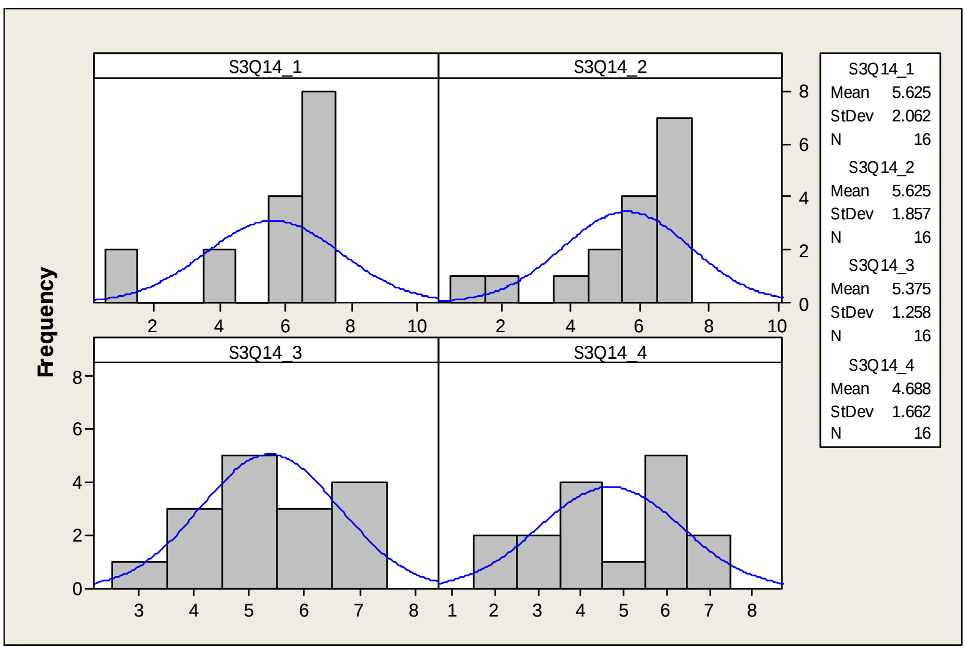

Figure 42: Histogram of S3Q14_1, S3Q14_2, S3Q14_3, and S3Q14_4

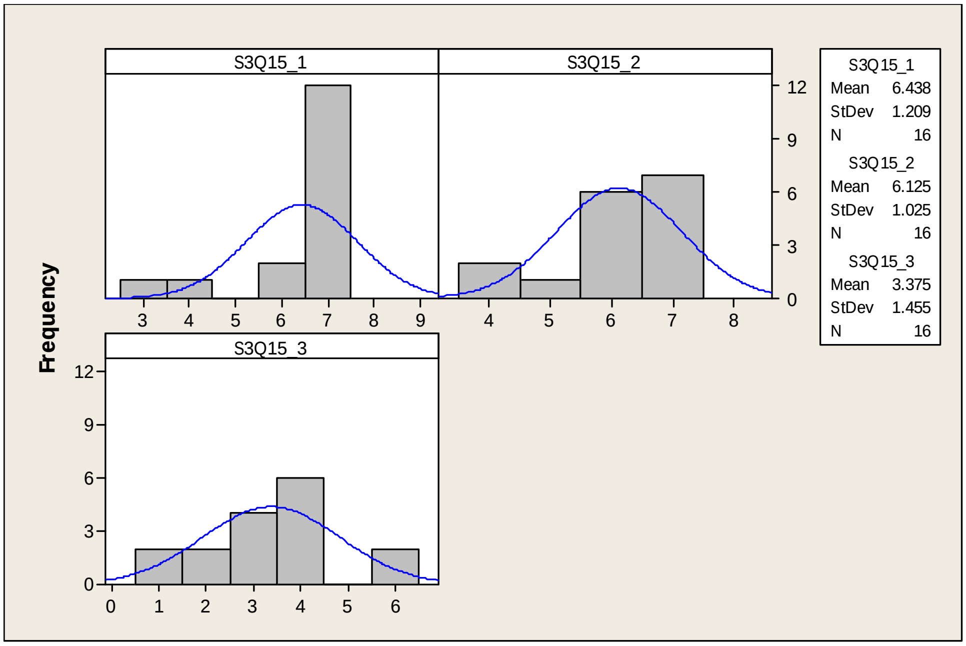

Figure 43: Histogram of S3Q15_1, S3Q15_2, and S3Q15_3

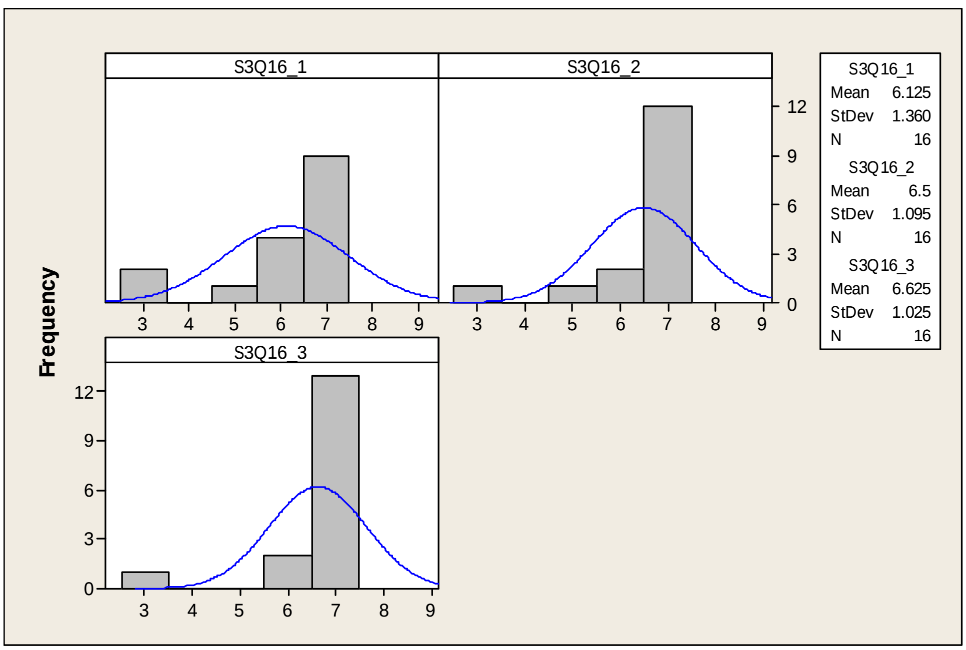

Figure 44: Histogram of S3Q16_1, S3Q16_2, and S3Q16_3

Appendix S Public Trust Model Formula Extract from AgenaRisk


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    <Links_between_Risk_Objects/>
  - <Risk_Object Number_Of_Nodes="89" Short_Description="New Risk Object" id="New Risk Object_0">
        <Input_Nodes/>
        <Output_Nodes/>
  - <Node id="M0" Name="100_Hearing" Type="Continuous Interval">
            <Parent_Node>M27@M61</Parent_Node>
            <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
            <NPT/>
            <Expression Partitioned="false" Simulation="true">Arithmetic((M27+M61)/2)</Expression>
            <Observations/>
    </Node>
  - <Node id="M0_1" Name="101_Understanding" Type="Continuous Interval">
            <Parent_Node>M0@M90@M91</Parent_Node>
            <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
            <NPT/>
            <Expression Partitioned="false" Simulation="true">Arithmetic((M0/100)*((M90+M91)/2))</Expression>
            <Observations/>
    </Node>
  - <Node id="M0_1_1" Name="102_Believing" Type="Continuous Interval">
            <Parent_Node>M0_1@M81@M92</Parent_Node>
            <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
            <NPT/>
            <Expression Partitioned="false" Simulation="true">Arithmetic((M0_1/100)*((M81+M92)/2))</Expression>
            <Observations/>
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  - <Node id="M0_1_1_1" Name="103_Acting" Type="Continuous Interval">
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            <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
            <NPT/>
            <Expression Partitioned="false" Simulation="true">Arithmetic((M0_1_1/100)*((M71+M73)/2))</Expression>
            <Observations/>
    </Node>
  - <Node id="M4" Name="99_Type_Of_Alert" Type="Labelled">
            <Parent_Node/>
            <States>Presidential Alert@Imminent Threat@Amber Alert</States>
          - <NPT>
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              <NPT_Row>0.33333334</NPT_Row>
              <NPT_Row>0.33333334</NPT_Row>
          </NPT>
            <Expression Partitioned="false" Simulation="false"/>
            <Observations/>
    </Node>
  - <Node id="M4_1" Name="7_Frequency" Type="Continuous Interval">
            <Parent_Node/>
            <States>0.0 - 50.0@50.0 - 100.0</States>
          - <NPT>
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              <NPT_Row>0.5</NPT_Row>
          </NPT>
            <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
            <Observations/>
    </Node>
  - <Node id="M4_1_1" Name="44_Redundancy_Of_Alerting" Type="Continuous Interval">
            <Parent_Node/>
            <States>0.0 - 50.0@50.0 - 100.0</States>
          - <NPT>
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          </NPT>
            <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
            <Observations/>
    </Node>
  - <Node id="M4_1_1_1" Name="15_Easy_Addl_Follow_Us_Mechanisms" Type="Continuous Interval">
            <Parent_Node/>
            <States>0.0 - 50.0@50.0 - 100.0</States>
          - <NPT>
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          </NPT>
            <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
            <Observations/>
    </Node>
  - <Node id="M4_1_1_1_1" Name="71_Message_In_Primary_Language" Type="Continuous Interval">
            <Parent_Node/>
            <States>0.0 - 50.0@50.0 - 100.0</States>
          - <NPT>
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          </NPT>
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        <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
        <Observations/>
  </Node>
- <Node id="M4_1_1_2" Name="55_Local_Jurisdictions_Act_Uncoordinated" Type="Continuous Interval">
        <Parent_Node/>
        <States>0.0 - 50.0@50.0 - 100.0</States>
      - <NPT>
          <NPT_Row>0.5</NPT_Row>
          <NPT_Row>0.5</NPT_Row>
    </NPT>
        <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
        <Observations/>
  </Node>
- <Node id="M4_1_1_2_1" Name="21_Clarity_Message_Spelling_Grammar_Content" Type="Continuous Interval">
        <Parent_Node/>
        <States>0.0 - 50.0@50.0 - 100.0</States>
      - <NPT>
          <NPT_Row>0.5</NPT_Row>
          <NPT_Row>0.5</NPT_Row>
    </NPT>
        <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
        <Observations/>
  </Node>
  - <Node id="M4_1_1_2_1_1" Name="3_Public_Awareness_of_WEA" Type="Continuous Interval">
        <Parent_Node/>
        <States>0.0 - 50.0@50.0 - 100.0</States>
      - <NPT>
          <NPT_Row>0.5</NPT_Row>
          <NPT_Row>0.5</NPT_Row>
    </NPT>
        <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
        <Observations/>
  </Node>
  - <Node id="M4_1_1_2_1_1_1" Name="20_History_Of_Relevance" Type="Continuous Interval">
        <Parent_Node/>
        <States>0.0 - 50.0@50.0 - 100.0</States>
      - <NPT>
          <NPT_Row>0.5</NPT_Row>
          <NPT_Row>0.5</NPT_Row>
    </NPT>
        <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
        <Observations/>
  </Node>
- <Node id="M4_1_2" Name="4_Opt_Out_Rate" Type="Continuous Interval">
        <Parent_Node>M28@M29@M30</Parent_Node>
        <States>0.0 - 50.0@50.0 - 100.0</States>
      - <NPT>
          <NPT_Row>0.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@0.7368421@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@0.68421054@1.0@1.0@0.7368421@1.
          <NPT_Row>0.0@0.0@0.0@0.0@0.0@0.0@0.0@0.0@0.2631579@0.0@0.0@0.0@0.0@0.0@0.0@0.0@0.0@0.31578946@0.0@0.0@0.2631579@0.
    </NPT>
        <Expression Partitioned="false" Simulation="false">Arithmetic((M28+M29+M30)/3)</Expression>
        <Observations/>
  </Node>
- <Node id="M4_2" Name="48_Alerts_Viewed_As_Spam" Type="Continuous Interval">
        <Parent_Node>M54@M77@M93</Parent_Node>
        <States>0.0 - 50.0@50.0 - 100.0</States>
      - <NPT>
          <NPT_Row>0.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@0.7368421@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@0.68421054@1.0@1.0@0.7368421@1.
          <NPT_Row>0.0@0.0@0.0@0.0@0.0@0.0@0.0@0.0@0.2631579@0.0@0.0@0.0@0.0@0.0@0.0@0.0@0.0@0.31578946@0.0@0.0@0.2631579@0.
    </NPT>
        <Expression Partitioned="false" Simulation="false">Arithmetic((M93+M54+M77)/3)</Expression>
        <Observations/>
  </Node>
- <Node id="M0_1_1_2" Name="37_Confirmation_By_Social_Media" Type="Continuous Interval">
        <Parent_Node>M43</Parent_Node>
        <States>0.0 - 50.0@50.0 - 100.0</States>
      - <NPT>
          <NPT_Row>0.0@1.0@0.44444445</NPT_Row>
          <NPT_Row>0.0@0.0@0.5555556</NPT_Row>
    </NPT>
        <Expression Partitioned="false" Simulation="false">Arithmetic(M43)</Expression>
        <Observations/>
  </Node>
  - <Node id="M4_1_1_2_1_1_1_1_1" Name="10_Action_To_Take" Type="Continuous Interval">
        <Parent_Node/>
        <States>0.0 - 50.0@50.0 - 100.0</States>
      - <NPT>
          <NPT_Row>0.5</NPT_Row>
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    </NPT>
        <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
        <Observations/>
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  </Node>
- <Node id="M4_1_1_2_1_1_1_1_1_1" Name="12_Alert_Source" Type="Labelled">
      <Parent_Node/>
      <States>Local@State@Federal</States>
    - <NPT>
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        <NPT_Row>0.33333334</NPT_Row>
        <NPT_Row>0.33333334</NPT_Row>
    </NPT>
      <Expression Partitioned="false" Simulation="false"/>
      <Observations/>
  </Node>
- <Node id="M4_1_1_2_1_1_1_1_1_2" Name="26_Where_To_Go_For_More_Info" Type="Continuous Interval">
      <Parent_Node/>
      <States>0.0 - 50.0@50.0 - 100.0</States>
    - <NPT>
        <NPT_Row>0.5</NPT_Row>
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    </NPT>
      <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
      <Observations/>
  </Node>
- <Node id="M4_1_1_2_1_1_1_1_1_3" Name="8_History_Of_Final_Communication" Type="Continuous Interval">
      <Parent_Node/>
      <States>0.0 - 50.0@50.0 - 100.0</States>
    - <NPT>
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    </NPT>
      <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
      <Observations/>
  </Node>
- <Node id="M4_1_1_2_1_1_1_1_1_4" Name="70_Why_Should_I_Act" Type="Continuous Interval">
      <Parent_Node/>
      <States>0.0 - 50.0@50.0 - 100.0</States>
    - <NPT>
        <NPT_Row>0.5</NPT_Row>
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    </NPT>
      <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
      <Observations/>
  </Node>
- <Node id="M4_1_1_2_1_1_1_1_1_5" Name="1_Relevance" Type="Continuous Interval">
      <Parent_Node>M46@M38@M40</Parent_Node>
      <States>0.0 - 50.0@50.0 - 100.0</States>
    - <NPT>
        <NPT_Row>0.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@0.7368421@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@0.68421054@1.0@1.0@0.7368421@1.
        <NPT_Row>0.0@0.0@0.0@0.0@0.0@0.0@0.0@0.0@0.2631579@0.0@0.0@0.0@0.0@0.0@0.0@0.0@0.0@0.31578946@0.0@0.0@0.2631579@0.
    </NPT>
      <Expression Partitioned="false" Simulation="false">Arithmetic((M46+M38+M40)/3)</Expression>
      <Observations/>
  </Node>
  - <Node id="M4_1_1_2_1_1_1_1_1_6" Name="23_Who_Should_Act" Type="Continuous Interval">
      <Parent_Node/>
      <States>0.0 - 50.0@50.0 - 100.0</States>
    - <NPT>
        <NPT_Row>0.5</NPT_Row>
        <NPT_Row>0.5</NPT_Row>
    </NPT>
      <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
      <Observations/>
  </Node>
- <Node id="M4_1_1_2_1_1_1_1_1_7" Name="30_Explain_What" Type="Continuous Interval">
      <Parent_Node/>
      <States>0.0 - 50.0@50.0 - 100.0</States>
    - <NPT>
        <NPT_Row>0.5</NPT_Row>
        <NPT_Row>0.5</NPT_Row>
    </NPT>
      <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
      <Observations/>
  </Node>
- <Node id="M4_1_1_2_1_1_1_1_1_8" Name="32_Lead_Time_Provided" Type="Continuous Interval">
      <Parent_Node/>
      <States>0.0 - 50.0@50.0 - 100.0</States>
    - <NPT>
        <NPT_Row>0.5</NPT_Row>
        <NPT_Row>0.5</NPT_Row>
    </NPT>
      <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
      <Observations/>
  </Node>
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- <Node id="M4_1_1_2_1_1_1_1_1_9" Name="24_Time_Window_To_Act" Type="Continuous Interval">
      <Parent_Node/>
      <States>0.0 - 50.0@50.0 - 100.0</States>
    - <NPT>
        <NPT_Row>0.5</NPT_Row>
        <NPT_Row>0.5</NPT_Row>
    </NPT>
      <Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
      <Observations/>
  </Node>
  - <Node id="M27" Name="Hearing per Opt Out" Type="Continuous Interval">
      <Parent_Node>M4_1_2</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
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        <NPT_Row>0.0@0.0</NPT_Row>
        <NPT_Row>1.0@1.0</NPT_Row>
    </NPT>
      <Expression Partitioned="true" Simulation="true">Arithmetic(M4_1_2)M4_1_2@#</Expression>
      <Observations/>
  </Node>
- <Node id="M28" Name="Opt Out per Uncoordinated" Type="Continuous Interval">
      <Parent_Node>M4_1_1_2</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
        <NPT_Row>0.0@0.0</NPT_Row>
        <NPT_Row>0.078947365@0.00877193</NPT_Row>
        <NPT_Row>0.92105263@0.99122804</NPT_Row>
    </NPT>
      <Expression Partitioned="true" Simulation="true">M4_1_1_2@#Uniform(2.5,97.5)Triangle(2.5,97.5,70)</Expression>
      <Observations/>
  </Node>
  - <Node id="M29" Name="Opt Out per Spam" Type="Continuous Interval">
      <Parent_Node>M4_2</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
        <NPT_Row>0.0@0.0</NPT_Row>
        <NPT_Row>0.078947365@0.00877193</NPT_Row>
        <NPT_Row>0.92105263@0.99122804</NPT_Row>
    </NPT>
      <Expression Partitioned="true" Simulation="true">M4_2@#Uniform(2.5,97.5)Triangle(2.5,97.5,70)</Expression>
      <Observations/>
  </Node>
- <Node id="M30" Name="Opt Out per Redundancy" Type="Continuous Interval">
      <Parent_Node>M4_1_1</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
        <NPT_Row>0.0@0.0</NPT_Row>
        <NPT_Row>0.078947365@0.021531101</NPT_Row>
        <NPT_Row>0.92105263@0.9784689</NPT_Row>
    </NPT>
      <Expression Partitioned="true" Simulation="true">M4_1_1@#Uniform(2.5,97.5)Triangle(2.5,97.5,30)</Expression>
      <Observations/>
  </Node>
  - <Node id="M31" Name="Believing per Explain" Type="Continuous Interval">
      <Parent_Node>M4_1_1_2_1_1_1_1_1_7</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
        <NPT_Row>0.0@0.0</NPT_Row>
        <NPT_Row>0.00877193@0.00877193</NPT_Row>
        <NPT_Row>0.99122804@0.99122804</NPT_Row>
    </NPT>
      <Expression Partitioned="true" Simulation="true">M4_1_1_2_1_1_1_1_1_7@#Triangle(2.5,97.5,70)Triangle(2.5,97.5,70)</Expression>
      <Observations/>
  </Node>
  - <Node id="M32" Name="Act per Action" Type="Continuous Interval">
      <Parent_Node>M4_1_1_2_1_1_1_1_1</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
        <NPT_Row>0.0@0.0</NPT_Row>
        <NPT_Row>0.00877193@0.007842454</NPT_Row>
        <NPT_Row>0.99122804@0.9921575</NPT_Row>
    </NPT>
      <Expression Partitioned="true" Simulation="true">M4_1_1_2_1_1_1_1_1@#Triangle(2.5,97.5,70)Triangle(2.5,97.5,78.75)</Expression>
      <Observations/>
  </Node>
  - <Node id="M33" Name="Act per Time Window" Type="Continuous Interval">
      <Parent_Node>M4_1_1_2_1_1_1_1_1_9</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
        <NPT_Row>0.0@0.0</NPT_Row>
        <NPT_Row>0.00877193@0.007842454</NPT_Row>
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            <NPT_Row>0.99122804@0.9921575</NPT_Row>
        </NPT>
          <Expression Partitioned="true" Simulation="true">M4_1_1_2_1_1_1_1_1_9@#Triangle(2.5,97.5,70)Triangle(2.5,97.5,78.75)</Expression>
          <Observations/>
    </Node>
-   <Node id="M34" Name="Believing per Redundancy" Type="Continuous Interval">
          <Parent_Node>M4_1_1</Parent_Node>
          <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        -   <NPT>
            <NPT_Row>0.0@0.0</NPT_Row>
            <NPT_Row>0.012465374@0.00877193</NPT_Row>
            <NPT_Row>0.98753464@0.99122804</NPT_Row>
        </NPT>
          <Expression Partitioned="true" Simulation="true">M4_1_1@#Triangle(2.5,97.5,50)Triangle(2.5,97.5,70)</Expression>
          <Observations/>
    </Node>
    -   <Node id="M35" Name="Act per Lead Time" Type="Continuous Interval">
          <Parent_Node>M4_1_1_2_1_1_1_1_1_8</Parent_Node>
          <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        -   <NPT>
            <NPT_Row>0.0@0.0</NPT_Row>
            <NPT_Row>0.00877193@0.007007163</NPT_Row>
            <NPT_Row>0.99122804@0.9929928</NPT_Row>
        </NPT>
          <Expression Partitioned="true" Simulation="true">M4_1_1_2_1_1_1_1_1_8@#Triangle(2.5,97.5,70)Triangle(2.5,97.5,87.5)</Expression>
          <Observations/>
    </Node>
    -   <Node id="M36" Name="Act per Relevance" Type="Continuous Interval">
          <Parent_Node>M4_1_1_2_1_1_1_1_1_5</Parent_Node>
          <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        -   <NPT>
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            <NPT_Row>0.06965944@0.007007163</NPT_Row>
            <NPT_Row>0.9303405@0.9929928</NPT_Row>
        </NPT>
          <Expression Partitioned="true" Simulation="true">M4_1_1_2_1_1_1_1_1_5@#Triangle(2.5,87.5,12.5)Triangle(2.5,97.5,87.5)</Expression>
          <Observations/>
    </Node>
    -   <Node id="M37" Name="Act per Who Should" Type="Continuous Interval">
          <Parent_Node>M4_1_1_2_1_1_1_1_1_6</Parent_Node>
          <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        -   <NPT>
            <NPT_Row>0.0@0.0</NPT_Row>
            <NPT_Row>0.00877193@0.007007163</NPT_Row>
            <NPT_Row>0.99122804@0.9929928</NPT_Row>
        </NPT>
          <Expression Partitioned="true" Simulation="true">M4_1_1_2_1_1_1_1_1_6@#Triangle(2.5,97.5,70)Triangle(2.5,97.5,87.5)</Expression>
          <Observations/>
    </Node>
    -   <Node id="M38" Name="Relevance per Who" Type="Continuous Interval">
          <Parent_Node>M4_1_1_2_1_1_1_1_1_6</Parent_Node>
          <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        -   <NPT>
            <NPT_Row>0.0@0.0</NPT_Row>
            <NPT_Row>0.007007163@0.007007163</NPT_Row>
            <NPT_Row>0.9929928@0.9929928</NPT_Row>
        </NPT>
          <Expression Partitioned="true" Simulation="true">M4_1_1_2_1_1_1_1_1_6@#Triangle(2.5,97.5,87.5)Triangle(2.5,97.5,87.5)</Expression>
          <Observations/>
    </Node>
    -   <Node id="M39" Name="Believing per Final" Type="Continuous Interval">
          <Parent_Node>M4_1_1_2_1_1_1_1_1_3</Parent_Node>
          <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        -   <NPT>
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            <NPT_Row>0.021531101@0.00877193</NPT_Row>
            <NPT_Row>0.9784689@0.99122804</NPT_Row>
        </NPT>
          <Expression Partitioned="true" Simulation="true">M4_1_1_2_1_1_1_1_1_3@#Triangle(2.5,97.5,30)Triangle(2.5,97.5,70)</Expression>
          <Observations/>
    </Node>
-   <Node id="M40" Name="Relevance per Explanation" Type="Continuous Interval">
          <Parent_Node>M4_1_1_2_1_1_1_1_1_7</Parent_Node>
          <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        -   <NPT>
            <NPT_Row>0.0@0.0</NPT_Row>
            <NPT_Row>0.00877193@0.00877193</NPT_Row>
            <NPT_Row>0.99122804@0.99122804</NPT_Row>
        </NPT>
          <Expression Partitioned="true" Simulation="true">M4_1_1_2_1_1_1_1_1_7@#Triangle(2.5,97.5,70)Triangle(2.5,97.5,70)</Expression>
          <Observations/>
    </Node>
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- <Node id="M41" Name="Understand per Uncoordinated" Type="Continuous Interval">
      <Parent_Node>M4_1_1_2</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
        <NPT_Row>0.0@0.0</NPT_Row>
        <NPT_Row>0.007007163@0.021531101</NPT_Row>
        <NPT_Row>0.9929928@0.9784689</NPT_Row>
    </NPT>
      <Expression Partitioned="true" Simulation="true">M4_1_1_2@#Triangle(2.5,97.5,87.5)Triangle(2.5,97.5,30)</Expression>
      <Observations/>
  </Node>
  - <Node id="M42" Name="Believing per Local" Type="Continuous Interval">
      <Parent_Node>M4_1_1_2</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
        <NPT_Row>0.0@0.0</NPT_Row>
        <NPT_Row>0.012465374@0.00877193</NPT_Row>
        <NPT_Row>0.98753464@0.99122804</NPT_Row>
    </NPT>
      <Expression Partitioned="true" Simulation="true">M4_1_1_2@#Triangle(2.5,97.5,50)Triangle(2.5,97.5,70)</Expression>
      <Observations/>
  </Node>
- <Node id="M43" Name="Confirmation per Local" Type="Continuous Interval">
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        <NPT_Row>0.92105263@0.92105263</NPT_Row>
    </NPT>
      <Expression  Partitioned="true"  Simulation="true">M4_1_1_2@#Uniform(2.5,97.5)Uniform(2.5,97.5)</Expression>
      <Observations/>
  </Node>
- <Node id="M44" Name="Believing per Confirmation" Type="Continuous Interval">
      <Parent_Node>M0_1_1_2</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
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    </NPT>
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      <Observations/>
  </Node>
  - <Node id="M45" Name="Believing per Why" Type="Continuous Interval">
      <Parent_Node>M4_1_1_2_1_1_1_1_1_4</Parent_Node>
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    - <NPT>
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    </NPT>
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      <Observations/>
  </Node>
- <Node id="M46" Name="Relevance per Why Act" Type="Continuous Interval">
      <Parent_Node>M4_1_1_2_1_1_1_1_1_4</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
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      <Observations/>
  </Node>
  - <Node id="M47" Name="Believing per Spelling" Type="Continuous Interval">
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      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
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    </NPT>
      <Expression Partitioned="true" Simulation="true">M4_1_1_2_1@#Triangle(2.5,97.5,50)Triangle(2.5,97.5,70)</Expression>
      <Observations/>
  </Node>
- <Node id="M48" Name="Believing per Awareness" Type="Continuous Interval">
      <Parent_Node>M4_1_1_2_1_1</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
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        <NPT_Row>0.015789473@0.00877193</NPT_Row>
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      <Observations/>
  </Node>
- <Node id="M49" Name="Believing per Relevance" Type="Continuous Interval">
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      <Observations/>
  </Node>
- <Node id="M50" Name="Believing per Wasted Alerts" Type="Continuous Interval">
      <Parent_Node>M60</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
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      </NPT>
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      <Observations/>
  </Node>
  - <Node id="M51" Name="Believing per Source" Type="Continuous Interval">
      <Parent_Node>M4_1_1_2_1_1_1_1_1</Parent_Node>
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    - <NPT>
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      </NPT>
      <Expression Partitioned="true" Simulation="true">M4_1_1_2_1_1_1_1_1@#Triangle(2.5,97.5,70)Triangle(2.5,97.5,70)Triangle(2.5,97.5,70)
        </Expression>
      <Observations/>
  </Node>
- <Node id="M52" Name="Believing per More Info" Type="Continuous Interval">
      <Parent_Node>M4_1_1_2_1_1_1_1_2</Parent_Node>
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        <NPT_Row>0.99122804@0.99122804</NPT_Row>
      </NPT>
      <Expression Partitioned="true" Simulation="true">M4_1_1_2_1_1_1_1_2@#Triangle(2.5,97.5,70)Triangle(2.5,97.5,70)</Expression>
      <Observations/>
  </Node>
  - <Node id="M53" Name="Spam per Alert Type" Type="Continuous Interval">
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      </NPT>
      <Expression Partitioned="true" Simulation="true">M4@#Triangle(2.5,97.5,30)Triangle(2.5,97.5,30)Triangle(2.5,97.5,30)</Expression>
      <Observations/>
  </Node>
  - <Node id="M54" Name="Spam per Relevance" Type="Continuous Interval">
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    - <NPT>
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        <NPT_Row>0.99122804@0.93767315</NPT_Row>
      </NPT>
      <Expression Partitioned="true" Simulation="true">M4_1_1_2_1_1_1_1_5@#Triangle(2.5,97.5,70)Triangle(2.5,97.5,12.5)</Expression>
      <Observations/>
  </Node>
- <Node id="M55" Name="Understanding per Language" Type="Continuous Interval">
      <Parent_Node>M4_1_1_1_1</Parent_Node>
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        <NPT_Row>0.98753464@0.9929928</NPT_Row>
      </NPT>
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<Observations/>
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- <Node id="M56" Name="Spam per Awareness" Type="Continuous Interval">
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- <NPT>
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<NPT_Row>0.9929928@0.9784689</NPT_Row>
</NPT>
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- <Node id="M57" Name="Spam per Relevance" Type="Continuous Interval">
<Parent_Node>M4_1_1_2_1_1_1</Parent_Node>
<States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
- <NPT>
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<NPT_Row>0.98753464@0.93767315</NPT_Row>
</NPT>
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<Observations/>
</Node>
- <Node id="M58" Name="Spam per Spelling" Type="Continuous Interval">
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<NPT_Row>0.92105263@0.98753464</NPT_Row>
</NPT>
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<Observations/>
</Node>
- <Node id="M59" Name="Spam per Wasted Alerts" Type="Continuous Interval">
<Parent_Node>M60</Parent_Node>
<States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
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</NPT>
<Expression Partitioned="true" Simulation="true">M60@#TNormal(5,1,0,100.0)TNormal(89,1,0,100.0)</Expression>
<Observations/>
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- <Node id="M60" Name="33_Degree_Wasted_Alerts" Type="Continuous Interval">
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- <NPT>
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</NPT>
<Expression Partitioned="false" Simulation="false">Uniform(0,100)</Expression>
<Observations/>
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- <Node id="M61" Name="Hearing Per Spam" Type="Continuous Interval">
<Parent_Node>M4_2</Parent_Node>
<States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
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<Observations/>
</Node>
- <Node id="M62" Name="Understanding per Spelling" Type="Continuous Interval">
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<States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
- <NPT>
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<NPT_Row>0.99122804@0.9929928</NPT_Row>
</NPT>
<Expression Partitioned="true" Simulation="true">M4_1_1_2_1@#Triangle(2.5,97.5,70)Triangle(2.5,97.5,87.5)</Expression>
<Observations/>
</Node>
- <Node id="M67" Name="Spam per Redundancy" Type="Continuous Interval">
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- <NPT>
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        </NPT>
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        <Observations/>
    </Node>
-   <Node id="M68" Name="Spam per Frequency" Type="Continuous Interval">
        <Parent_Node>M4_1</Parent_Node>
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        </NPT>
        <Expression Partitioned="true" Simulation="true">M4_1@#Triangle(2.5,97.5,12.5)Triangle(2.5,97.5,70)</Expression>
        <Observations/>
    </Node>
-   <Node id="M69" Name="Understand per Easy Follow" Type="Continuous Interval">
        <Parent_Node>M4_1_1_1</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
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            <NPT_Row>0.00877193@0.007007163</NPT_Row>
            <NPT_Row>0.99122804@0.9929928</NPT_Row>
        </NPT>
        <Expression Partitioned="true" Simulation="true">M4_1_1_1@#Triangle(2.5,97.5,70)Triangle(2.5,97.5,87.5)</Expression>
        <Observations/>
    </Node>
-   <Node id="M70" Name="Believing per Frequency" Type="Continuous Interval">
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      - <NPT>
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            <NPT_Row>0.9929928@0.9784689</NPT_Row>
        </NPT>
        <Expression Partitioned="true" Simulation="true">M4_1@#Triangle(2.5,97.5,87.5)Triangle(2.5,97.5,30)</Expression>
        <Observations/>
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-   <Node id="M71" Name="Combo 19" Type="Continuous Interval">
        <Parent_Node>M36@M37</Parent_Node>
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        <Observations/>
    </Node>
-   <Node id="M72" Name="Combo 12" Type="Continuous Interval">
        <Parent_Node>M35@M33</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M35+M33)/2)</Expression>
        <Observations/>
    </Node>
-   <Node id="M73" Name="Combo 13" Type="Continuous Interval">
        <Parent_Node>M32@M72</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M32+M72)/2)</Expression>
        <Observations/>
    </Node>
-   <Node id="M74" Name="Combo 05" Type="Continuous Interval">
        <Parent_Node>M59@M57</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M59+M57)/2)</Expression>
        <Observations/>
    </Node>
-   <Node id="M75" Name="Combo 04" Type="Continuous Interval">
        <Parent_Node>M56@M74</Parent_Node>
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        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M56+M74)/2)</Expression>
        <Observations/>
    </Node>
-   <Node id="M76" Name="Combo 03" Type="Continuous Interval">
        <Parent_Node>M75@M58</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M75+M58)/2)</Expression>
        <Observations/>
    </Node>
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- <Node id="M77" Name="Combo 02" Type="Continuous Interval">
        <Parent_Node>M68@M67</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M68+M67)/2)</Expression>
        <Observations/>
  </Node>
- <Node id="M78" Name="Combo 10" Type="Continuous Interval">
        <Parent_Node>M52@M51</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M52+M51)/2)</Expression>
        <Observations/>
  </Node>
- <Node id="M79" Name="Combo 06" Type="Continuous Interval">
        <Parent_Node>M50@M49</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M50+M49)/2)</Expression>
        <Observations/>
  </Node>
- <Node id="M80" Name="Combo 07" Type="Continuous Interval">
        <Parent_Node>M79@M48</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M79+M48)/2)</Expression>
        <Observations/>
  </Node>
- <Node id="M81" Name="Combo 08" Type="Continuous Interval">
        <Parent_Node>M80@M47</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M80+M47)/2)</Expression>
        <Observations/>
  </Node>
- <Node id="M82" Name="Combo 15" Type="Continuous Interval">
        <Parent_Node>M34@M70</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M34+M70)/2)</Expression>
        <Observations/>
  </Node>
- <Node id="M83" Name="Combo 16" Type="Continuous Interval">
        <Parent_Node>M42@M44</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M42+M44)/2)</Expression>
        <Observations/>
  </Node>
- <Node id="M84" Name="Combo 17" Type="Continuous Interval">
        <Parent_Node>M83@M82</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M83+M82)/2)</Expression>
        <Observations/>
  </Node>
- <Node id="M85" Name="Believing per Relevance" Type="Continuous Interval">
        <Parent_Node>M4_1_1_2_1_1_1_1_1_5</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
          - <NPT>
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      </NPT>
        <Expression Partitioned="true" Simulation="true">M4_1_1_2_1_1_1_1_1_5@#Triangle(2.5,97.5,70)Triangle(2.5,97.5,70)</Expression>
        <Observations/>
  </Node>
- <Node id="M86" Name="Combo 20" Type="Continuous Interval">
        <Parent_Node>M45@M85</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M45+M85)/2)</Expression>
        <Observations/>
  </Node>
- <Node id="M87" Name="Combo 21" Type="Continuous Interval">
        <Parent_Node>M31@M86</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
        <NPT/>
        <Expression  Partitioned="false"  Simulation="true">Arithmetic((M31+M86)/2)</Expression>
        <Observations/>
  </Node>
- <Node id="M88" Name="Combo 22" Type="Continuous Interval">
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          <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
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          <Observations/>
      </Node>
    - <Node id="M89" Name="Combo 18" Type="Continuous Interval">
          <Parent_Node>M84@M88</Parent_Node>
          <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
          <NPT/>
          <Expression Partitioned="false" Simulation="true">Arithmetic((M84+M88)/2)</Expression>
          <Observations/>
      </Node>
    - <Node id="M90" Name="Combo 09" Type="Continuous Interval">
          <Parent_Node>M55@M62</Parent_Node>
          <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
          <NPT/>
          <Expression Partitioned="false" Simulation="true">Arithmetic((M55+M62)/2)</Expression>
          <Observations/>
      </Node>
    - <Node id="M91" Name="Combo 14" Type="Continuous Interval">
          <Parent_Node>M41@M69</Parent_Node>
          <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
          <NPT/>
          <Expression Partitioned="false" Simulation="true">Arithmetic((M41+M69)/2)</Expression>
          <Observations/>
      </Node>
    - <Node id="M92" Name="Combo 11" Type="Continuous Interval">
          <Parent_Node>M78@M89</Parent_Node>
          <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
          <NPT/>
          <Expression Partitioned="false" Simulation="true">Arithmetic((M78+M89)/2)</Expression>
          <Observations/>
      </Node>
    - <Node id="M93" Name="Combo 01" Type="Continuous Interval">
          <Parent_Node>M76@M53</Parent_Node>
          <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
          <NPT/>
          <Expression Partitioned="false" Simulation="true">Arithmetic((M76+M53)/2)</Expression>
          <Observations/>
      </Node>
  </Risk_Object>
</Risk_Model>
```

Appendix T Alert Originator Trust Model Formula Extract from AgenaRisk


```xml
<?xml version="1.0" encoding="UTF-8"?>
<Risk_Model Number_Of_Risk_Objects="1">
    <Links_between_Risk_Objects/>
  - <Risk_Object Number_Of_Nodes="74" Short_Description="New Risk Object" id="New Risk Object_0">
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      <Output_Nodes/>
    - <Node id="M0" Name="WEA Utilization" Type="Continuous Interval">
          <Parent_Node>M1@M3@M2</Parent_Node>
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        </NPT>
          <Expression Partitioned="false" Simulation="true">Arithmetic(((M1/100)*(M2/100)*(M3/100))*100)</Expression>
          <Observations/>
      </Node>
    - <Node id="M1" Name="Appropriate" Type="Continuous Interval">
          <Parent_Node>M42_1@M42@M50</Parent_Node>
          <States>0.0 - 50.0@50.0 - 100.0</States>
        - <NPT>
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        </NPT>
          <Expression Partitioned="false" Simulation="false">Arithmetic(( ( (1/M42) / ((1/M42)+(1/M42_1)+(1/M50)) )*M42) + ( ( (1/M42_1) / ((1/M42)+
            (1/M42_1)+(1/M50)) )*M42_1) + ( ( (1/M50) / ((1/M42)+(1/M42_1)+(1/M50)) )*M50))</Expression>
          <Observations/>
      </Node>
      - <Node id="M2" Name="Available" Type="Continuous Interval">
          <Parent_Node>M78@M79@M80</Parent_Node>
          <States>0.0 - 50.0@50.0 - 100.0</States>
        - <NPT>
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            <NPT_Row>1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0
        </NPT>
          <Expression Partitioned="false" Simulation="false">Arithmetic(( ( (1/M78) / ((1/M78)+(1/M79)+(1/M80)) )*M78) + ( ( (1/M79) / ((1/M78)+(1/M79)+
            (1/M80)) )*M79) + ( ( (1/M80) / ((1/M78)+(1/M79)+(1/M80)) )*M80))</Expression>
          <Observations/>
      </Node>
      - <Node id="M3" Name="Effective" Type="Continuous Interval">
          <Parent_Node>M71@M64</Parent_Node>
          <States>0.0 - 50.0@50.0 - 100.0</States>
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        </NPT>
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            </Expression>
          <Observations/>
      </Node>
      - <Node id="M6" Name="Geographic Breadth" Type="Labelled">
          <Parent_Node/>
          <States>70% outside zone@50% outside zone@30% outside zone@10% outside zone</States>
        - <NPT>
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          <Observations/>
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      - <Node id="M8" Name="Responsibility" Type="Labelled">
          <Parent_Node/>
          <States>50% Confidence It's Yours@70% Confidence It's Yours@90% Confidence It's Yours@99% Confidence It's Yours</States>
        - <NPT>
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      </Node>
      - <Node id="M9" Name="Time of Day" Type="Labelled">
          <Parent_Node/>
          <States>10:30 am@6:30 pm@2:30 am</States>
        - <NPT>
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        </NPT>
```

```
      <Expression Partitioned="false" Simulation="false"/>
      <Observations/>
  </Node>
  - <Node id="M11" Name="System Readiness" Type="Labelled">
      <Parent_Node/>
      <States>Unavailable 1 hr per week@Unavailable 1 hr per month@Unavailable 1 hr per year</States>
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  </Node>
  - <Node id="M13" Name="System Accessibility" Type="Labelled">
      <Parent_Node/>
      <States>Several Designated and Remote@Several Designated@Primary Office</States>
      - <NPT>
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  </Node>
  - <Node id="M14" Name="System Reliability" Type="Labelled">
      <Parent_Node/>
      <States>99.9%@99%@90%</States>
      - <NPT>
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  </Node>
  - <Node id="M16" Name="Security" Type="Labelled">
      <Parent_Node/>
      <States>No attacks in past year@Unsuccessful in past year@Successful in past year per users@Successful in past year per agency</States>
      - <NPT>
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  </Node>
  - <Node id="M17" Name="Magnitude of Effort" Type="Labelled">
      <Parent_Node/>
      <States>5 mins@10 mins@20 mins@40 mins</States>
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- <Node id="M18" Name="Cross System Integration" Type="Labelled">
      <Parent_Node/>
      <States>No integration@Integrated to other systems</States>
      - <NPT>
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  - <Node id="M19" Name="Template" Type="Labelled">
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  </Node>
  - <Node id="M20" Name="Skills Competencies" Type="Labelled">
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```
<States>40 hrs training@16 hrs training@4 hrs training</States>
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- <Node id="M21" Name="Understanding" Type="Labelled">
    <Parent_Node/>
    <States>Thorough@Moderate@Minimal</States>
  - <NPT>
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  </Node>
- <Node id="M22" Name="Practice" Type="Labelled">
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    <States>Twice per week@Twice per month@Twice per year</States>
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  </Node>
- <Node id="M23" Name="Timeliness of Dissemination" Type="Labelled">
    <Parent_Node/>
    <States>< 2 mins@2-5 mins@5-10 mins@10-30 mins</States>
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- <Node id="M24" Name="Public Awareness" Type="Labelled">
    <Parent_Node/>
    <States>Public previously informed of WEA@Public not previously informed of WEA</States>
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    </NPT>
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  </Node>
- <Node id="M25" Name="System Feedback" Type="Continuous Interval">
    <Parent_Node>M52@M53</Parent_Node>
    <States>0.0 - 50.0@50.0 - 100.0</States>
  - <NPT>
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    </NPT>
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      </Expression>
    <Observations/>
  </Node>
- <Node id="M26" Name="Alert Frequency" Type="Labelled">
    <Parent_Node/>
    <States>Several in past week@Several in past month@Several in past year</States>
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    </NPT>
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    <Observations/>
  </Node>
- <Node id="M27" Name="After Action Review Data" Type="Labelled">
    <Parent_Node/>
    <States>Unfavorable@Neutral@Favorable</States>
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```
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  - <Node id="M29" Name="Understandability" Type="Labelled">
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        <Observations/>
  </Node>
  - <Node id="M30" Name="Public Feedback" Type="Labelled">
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        <States>Unfavorable@Neutral@Favorable</States>
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  </Node>
  - <Node id="M31" Name="Historical Feedback" Type="Labelled">
        <Parent_Node/>
        <States>Nofeedback@Feedbackoftimeliness@Feedbackofuntimeliness</States>
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  </Node>
  - <Node id="M32" Name="Realtime Feedback" Type="Labelled">
        <Parent_Node/>
        <States>None@AckRec'd@AckRec'dAccepted@AckRec'dAcceptedForwarded@AckRec'dAcceptedForwardedTransmitted</States>
      - <NPT>
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        <Expression Partitioned="false" Simulation="false"/>
        <Observations/>
  </Node>
  - <Node id="M33" Name="Message Accuracy" Type="Labelled">
        <Parent_Node/>
        <States>Prior no errors@Prior minor errors@Prior major errors</States>
      - <NPT>
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        <Observations/>
  </Node>
  - <Node id="M34" Name="Location Accuracy" Type="Labelled">
        <Parent_Node/>
        <States>Prior Wrong Area@Prior Correct and Some Wrong Areas@Prior Only Portion of Correct Area</States>
      - <NPT>
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        <Expression Partitioned="false" Simulation="false"/>
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  </Node>
- <Node id="M38" Name="Appropriate per Time of Day" Type="Continuous Interval">
        <Parent_Node>M9</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
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      </NPT>
        <Expression Partitioned="true" Simulation="true">M9@#Triangle(30,97.5,97.5)Triangle(30,97.5,97.5)Triangle(2.5,97.5,97.5)</Expression>
```

```
      <Observations/>
  </Node>
- <Node id="M39" Name="Appropriate per Responsibility" Type="Continuous Interval">
      <Parent_Node>M8</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
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        <NPT_Row>1.0@1.0@1.0@1.0</NPT_Row>
    </NPT>
      <Expression Partitioned="true" Simulation="true">M8@#Triangle(30,97.5,78.5)Triangle(50,97.5,87.5)Triangle(50,97.5,92.5)Triangle(50,97.5,97.5)
        </Expression>
      <Observations/>
  </Node>
- <Node id="M40" Name="Appropriate per Geographic" Type="Continuous Interval">
      <Parent_Node>M6</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
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    </NPT>
      <Expression Partitioned="true" Simulation="true">M6@#Triangle(2.5,97.5,78.75)Triangle(12.5,97.5,92.5)Triangle(30,97.5,97.5)Triangle(50,97.5,97.5)
        </Expression>
      <Observations/>
  </Node>
- <Node id="M42" Name="Appropriate Function 02" Type="Continuous Interval">
      <Parent_Node>M45@M44</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
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    </NPT>
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        </Expression>
      <Observations/>
  </Node>
  - <Node id="M43" Name="Urgency" Type="Labelled">
      <Parent_Node/>
      <States>action within 10 mins@action within 30 mins@action within 60 mins@action within 2 hrs</States>
    - <NPT>
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      <Expression Partitioned="false" Simulation="false"/>
      <Observations/>
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- <Node id="M44" Name="Appropriate per Urgency" Type="Continuous Interval">
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      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
    - <NPT>
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    </NPT>
      <Expression Partitioned="true" Simulation="true">M43@#Triangle(50,97.5,97.5)Triangle(50,97.5,87.5)Triangle(12.5,97.5,70)Triangle(2.5,97.5,92.5)
        </Expression>
      <Observations/>
  </Node>
- <Node id="M45" Name="Appropriate per Certainty" Type="Continuous Interval">
      <Parent_Node>M46</Parent_Node>
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    </NPT>
      <Expression Partitioned="true" Simulation="true">M46@#Triangle(2.5,97.5,50)Triangle(30,97.5,70)Triangle(50,97.5,87.5)Triangle(50,97.5,97.5)
        </Expression>
      <Observations/>
  </Node>
  - <Nodeid="M46"Name="Certainty"Type="Labelled">
      <Parent_Node/>
      <States>30% Likely@50% LIkely@70% Likely@90% Likely</States>
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```
      </NPT>
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        <Observations/>
  </Node>
- <Node id="M47" Name="Severity" Type="Labelled">
        <Parent_Node/>
        <States>Extraordinary Life Threat@Significant Life Threat@Possible Life Threat@Extraordinary Property Threat@Significant Property Threat@Possible
          Property Threat</States>
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        <Observations/>
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    - <Node id="M48" Name="Appropriate per Severity" Type="Continuous Interval">
        <Parent_Node>M47</Parent_Node>
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          Triangle(2.5,97.5,70)Triangle(2.5,97.5,70)</Expression>
        <Observations/>
  </Node>
- <Node id="M42_1" Name="Appropriate Function 01" Type="Continuous Interval">
        <Parent_Node>M48@M40</Parent_Node>
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      </NPT>
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          </Expression>
        <Observations/>
  </Node>
    - <Node id="M50" Name="Appropriate Function 03" Type="Continuous Interval">
        <Parent_Node>M39@M38</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
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          </Expression>
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- <Node id="M52" Name="Sys Feedback per Historical" Type="Continuous Interval">
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        <Observations/>
  </Node>
- <Node id="M53" Name="Sys Feedback per Realtime" Type="Continuous Interval">
        <Parent_Node>M32</Parent_Node>
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        - <NPT>
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          (50,97.5,97.5)</Expression>
        <Observations/>
  </Node>
- <Node id="M55" Name="Accuracy per Location" Type="Continuous Interval">
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        - <NPT>
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- <Node id="M56" Name="Accuracy per Message" Type="Continuous Interval">
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- <Node id="M57" Name="Effective per Timeliness" Type="Continuous Interval">
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</Expression>
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- <Node id="M59" Name="Effective per Public Awareness" Type="Continuous Interval">
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- <Node id="M61" Name="Effective per Alert Frequency" Type="Continuous Interval">
<Parent_Node>M26</Parent_Node>
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- <Node id="M62" Name="Combination 01" Type="Continuous Interval">
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- <Node id="M63" Name="Combination 02" Type="Continuous Interval">
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</Node>
- <Node id="M64" Name="Combination 03" Type="Continuous Interval">
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          </Expression>
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-   <Node id="M65" Name="Effective per After Action" Type="Continuous Interval">
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        <Observations/>
    </Node>
-   <Node id="M66" Name="Effective per Accuracy" Type="Continuous Interval">
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          </Expression>
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    </Node>
-   <Node id="M67" Name="Effective per Understandability" Type="Continuous Interval">
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          </Expression>
        <Observations/>
    </Node>
-   <Node id="M68" Name="Effective per Public Feedback" Type="Continuous Interval">
        <Parent_Node>M30</Parent_Node>
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        <Observations/>
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  - <Node id="M69" Name="Combination 04" Type="Continuous Interval">
        <Parent_Node>M66@M65</Parent_Node>
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          </Expression>
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  - <Node id="M70" Name="Combination 05" Type="Continuous Interval">
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          </Expression>
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  - <Node id="M71" Name="Combination 06" Type="Continuous Interval">
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  </Node>
- <Node id="M72" Name="Available per System_@12" Type="Continuous Interval">
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      <Observations/>
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- <Node id="M73" Name="Available per System_@13" Type="Continuous Interval">
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- <Node id="M74" Name="Available per Ease of Use" Type="Continuous Interval">
      <Parent_Node>M81@M87</Parent_Node>
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        </Expression>
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  </Node>
- <Node id="M75" Name="Available per System Reliability" Type="Continuous Interval">
      <Parent_Node>M14</Parent_Node>
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- <Node id="M76" Name="Available per Training" Type="Continuous Interval">
      <Parent_Node>M84@M88</Parent_Node>
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        </Expression>
      <Observations/>
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- <Node id="M77" Name="Available per Security" Type="Continuous Interval">
      <Parent_Node>M16</Parent_Node>
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        </Expression>
      <Observations/>
  </Node>
  - <Node id="M78" Name="Combination 09" Type="Continuous Interval">
      <Parent_Node>M72@M73</Parent_Node>
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        </Expression>
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  </Node>
  - <Node id="M79" Name="Combination 08" Type="Continuous Interval">
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        </Expression>
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  </Node>
  - <Node id="M80" Name="Combination 07" Type="Continuous Interval">
      <Parent_Node>M76@M77</Parent_Node>
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        </Expression>
      <Observations/>
  </Node>
- <Node id="M81" Name="Ease of Use per Magnitude" Type="Continuous Interval">
      <Parent_Node>M17</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
      - <NPT>
          <NPT_Row>1.0@1.0@1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0@1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0@1.0@1.0</NPT_Row>
    </NPT>
      <Expression Partitioned="true" Simulation="true">M17@#Triangle(50,97.5,97.5)Triangle(12.5,97.5,87.5)Triangle(2.5,97.5,50)Triangle(2.5,97.5,30)
        </Expression>
      <Observations/>
  </Node>
- <Node id="M82" Name="Ease of Use per Cross System" Type="Continuous Interval">
      <Parent_Node>M18</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
      - <NPT>
          <NPT_Row>1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0</NPT_Row>
    </NPT>
      <Expression Partitioned="true" Simulation="true">M18@#Triangle(50,97.5,78.75)Triangle(50,97.5,97.5)</Expression>
      <Observations/>
  </Node>
- <Node id="M83" Name="Ease of Use per Template" Type="Continuous Interval">
      <Parent_Node>M19</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
      - <NPT>
          <NPT_Row>1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0</NPT_Row>
    </NPT>
      <Expression Partitioned="true" Simulation="true">M19@#Triangle(2.5,97.5,97.5)Triangle(2.5,97.5,87.5)</Expression>
      <Observations/>
  </Node>
  - <Node id="M84" Name="Training per Skill" Type="Continuous Interval">
      <Parent_Node>M20</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
      - <NPT>
          <NPT_Row>1.0@1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0@1.0</NPT_Row>
    </NPT>
      <Expression Partitioned="true" Simulation="true">M20@#Triangle(30,97.5,97.5)Triangle(50,97.5,87.5)Triangle(30,97.5,70)</Expression>
      <Observations/>
  </Node>
- <Node id="M85" Name="Training per Understanding" Type="Continuous Interval">
      <Parent_Node>M21</Parent_Node>
      <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
      - <NPT>
          <NPT_Row>1.0@1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0@1.0</NPT_Row>
    </NPT>
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```
        <Expression Partitioned="true" Simulation="true">M21@#Triangle(50,97.5,97.5)Triangle(2.5,97.5,70)Triangle(2.5,97.5,40)</Expression>
        <Observations/>
    </Node>
  - <Node id="M86" Name="Training per Practice" Type="Continuous Interval">
        <Parent_Node>M22</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
      - <NPT>
          <NPT_Row>1.0@1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0@1.0</NPT_Row>
      </NPT>
        <Expression Partitioned="true" Simulation="true">M22@#Triangle(2.5,97.5,87.5)Triangle(2.5,97.5,87.5)Triangle(2.5,97.5,50)</Expression>
        <Observations/>
    </Node>
    - <Node id="M87" Name="Combination 10" Type="Continuous Interval">
        <Parent_Node>M82@M83</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
      - <NPT>
          <NPT_Row>1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0</NPT_Row>
      </NPT>
        <Expression   Partitioned="false"   Simulation="true">Arithmetic((((1/M82)/((1/M82)+(1/M83)))*M82)+(((1/M83)/((1/M82)+(1/M83)))*M83))
          </Expression>
        <Observations/>
    </Node>
    - <Node id="M88" Name="Combination 11" Type="Continuous Interval">
        <Parent_Node>M85@M86</Parent_Node>
        <States>-Infinity - 0.0@0.0 - 10.0@10.0 - Infinity</States>
      - <NPT>
          <NPT_Row>1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0</NPT_Row>
          <NPT_Row>1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0@1.0</NPT_Row>
      </NPT>
        <Expression   Partitioned="false"   Simulation="true">Arithmetic((((1/M85)/((1/M85)+(1/M86)))*M85)+(((1/M86)/((1/M85)+(1/M86)))*M86))
          </Expression>
        <Observations/>
    </Node>
  </Risk_Object>
</Risk_Model>
```

Appendix U   Public Trust Model Validation Scenarios and Results

Scenarios				Factors					Responses								
#	Cases	Target Node	Scenario Description	30_Explain what has happened	70_Why I should act	23_Who should act			A	B	C	D	E	F	G	H	I
1	Case 1: Includes "what," includes "why," omits "who"	Relevance	"Nuclear plant radiation release in this area Take shelter now to avoid radiation exposure" How likely are you to consider this alert to be relevant to you?	1	1	0			6	4	4	7	3	6	3	7	7
	Case 2: Includes "what," omits "why," includes "who'	Relevance	"Nuclear plant radiation release in ZIP 12345 Take shelter now" How likely are you to consider this alert to be relevant to you?	1	0	1			6	6	5	7	5	7	5	5	7
	Case 3: omits "what," includes "why," in-cludes "who"	Relevance	"Nuclear power plant warning in ZIP 12345 Take shelter now to avoid radiation exposure" How likely are you to consider this alert to be relevant to you?	0	1	1			5	7	4	7	5	7	5	7	7

Scenarios				Factors					Responses								
#	Cases	Target Node	Scenario Description	30_Explain what has happened	70_Why I should act	23_Who should act			A	B	C	D	E	F	G	H	I
1	Case 4: omits "what," omits "why," omits "who"	Relevance	"Nuclear power plant warning in this area Take shelter now" How likely are you to consider this alert to be relevant to you?	0	0	0			4	2	3	7	4	6	2	5	7

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	10_Action to take	24_Time window to act	32_Lead time provided	23_Who should act	1_Relevance	A	B	C	D	E	F	G	H	I
2	Case 1: defined action, defined time, sufficient lead, includes “who,” irrelevant	Acting	“Flash flood in ZIP 12345 from 4:55 to 5:35 PM Evacuate low lying areas” You determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, or it does not address an emergency that affects you).	1	1	1	1	0	2	3	2	1	2	1	1	1	2
	Case 2: defined action, defined time, insufficient lead, omits “who,” relevant	Acting	“Flash flood in this area from 4:40 to 5:20 PM Evacuate low lying areas” You determine that the alert is relevant to you (e.g., it applies to your location, it is issued in a timely manner, and it addresses an emergency that affects you).	1	1	0	0	1	6	6	5	7	5	7	6	7	7
	Case 3: defined action, undefined time, sufficient lead, omits “who,” relevant	Acting	“Flash flood in this area at 4:55 PM Evacuate low lying areas” You determine that the alert is relevant to you (e.g., it applies to your location, it is issued in a timely manner, and it addresses an emergency that affects you).	1	0	1	0	1	7	6	5	7	6	7	6	7	6

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	10_Action to take	24_Time window to act	32_Lead time provided	23_Who should act	1_Relevance	A	B	C	D	E	F	G	H	I
2	Case 4: defined action, undefined time, insufficient lead, includes “who,” irrelevant	Acting	“Flash flood in ZIP 12345 at 4:40 PM Evacuate low lying areas” You determine that the alert <u>is not relevant</u> to you (e.g., it does not apply to your location, it is not issued in a timely manner, or it does not address an emergency that affects you).	1	0	0	1	0	1	7	2	1	1	1	2	1	2
	Case 5: undefined action, defined time, sufficient lead, omits “who,” irrelevant	Acting	“Flash flood in this area from 4:55 to 5:35 PM” You determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, or it does not address an emergency that affects you).	0	1	1	0	0	1	2	2	1	1	1	3	1	2
	Case 6: undefined action, defined time, insufficient lead, includes “who,” relevant	Acting	“Flash flood in ZIP 12345 from 4:40 to 5:20 PM” You determine that the alert <u>is relevant</u> to you (e.g., it applies to your location, it is issued in a timely manner, and it addresses an emergency that affects you).	0	1	0	1	1	5	7	4	7	6	7	6	7	7

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	10_Action to take	24_Time window to act	32_Lead time provided	23_Who should act	1_Relevance	A	B	C	D	E	F	G	H	I
2	Case 7: undefined action, undefined time, sufficient lead, in-cludes “who,” relevant	Acting	“Flash flood in ZIP 12345 from 4:55 PM” You determine that the alert <u>is relevant</u> to you (e.g., it applies to your location, it is issued in a timely manner, and it ad-dresses an emergency that affects you).	0	0	1	1	1	7	6	5	7	7	7	6	7	7
	Case 8: undefined action, undefined time, insufficient lead, omits “who,” irrelevant	Acting	“Flash flood in this area at 4:40 PM You determine that the alert <u>is not relevant</u> to you (e.g., it does not apply to your location, it is not issued in a timely manner, or it does not address an emergency that affects you).	0	0	0	0	0	1	2	5	1	1	1	2	1	2

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	99_Type of alert	7_Frequency	3_Public awareness of WEA	20_History of relevance		A	B	C	D	E	F	G	H	I
3	Case 1: imminent threat, few prior alerts, sufficient public outreach, history of relevance	View as spam	The alert pertains to an <u>imminent threat</u> (i.e., a flash flood) in your area Over the past 6 months, you have received <u>few alerts</u> - 6 from the National Weather Service regarding severe weather events, 1 AMBER alert, and 2 alerts from your city's EMA regarding local threats. You have previously <u>been made aware</u> of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA. You believe that most of the prior alerts that you have received <u>were relevant</u> to you.	1	1	1	1		2	6	3	1	2	2	2	1	2
3	Case 2: imminent threat, few prior alerts, insufficient public outreach, history of irrelevance	View as spam	The alert pertains to an <u>imminent threat</u> (i.e., a flash flood) in your area Over the past 6 months, you have received <u>few alerts</u> - 6 from the National Weather Service regarding severe weather events,1 AMBER alert, and 2 alerts from your city's EMA regarding local threats. You have <u>not been made aware</u> of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA. You believe that most of the prior alerts that you have received <u>were not relevant</u> to you.	1	1	0	0		4	4	5	1	5	5	5	6	2

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	99_Type of alert	7_Frequency	3_Public awareness of WEA	20_History of relevance		A	B	C	D	E	F	G	H	I
3	Case 3: imminent threat, many prior alerts, sufficient public outreach, history of irrelevance	View as spam	The alert pertains to an imminent threat (i.e., a flash flood) in your area Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events,12 AMBER alerts, and 18 alerts from your city's EMA regarding local threats. You have previously been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA. You believe that most of the prior alerts that you have received were not relevant to you.	1	0	1	0		3	6	3	1	5	4	6	6	2
	Case 4: imminent threat, many prior alerts, insufficient public outreach, history of relevance	View as spam	The alert pertains to an imminent threat (i.e., a flash flood) in your area Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events,12 AMBER alerts, and 18 alerts from your city's EMA regarding local threats. You have not been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA. You believe that most of the prior alerts that you have received were relevant to you.	1	0	0	1		3	3	4	1	4	3	4	2	2

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	99_Type of alert	7_Frequency	3_Public awareness of WEA	20_History of relevance		A	B	C	D	E	F	G	H	I
3	Case 5: AMBER alert, few alerts prior, sufficient public outreach, history of irrelevance	View as spam	The alert is an AMBER alert pertaining to a child abduction in your area Over the past 6 months, you have received few alerts - 6 from the National Weather Service regarding severe weather events,1 AMBER alert, and 2 alerts from your city's EMA regarding local threats. You have previously been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA. You believe that most of the prior alerts that you have received were not relevant to you.	0	1	1	0		2	5	4	1	3	4	5	4	2
	Case 6: AMBER alert, few prior alerts, insufficient public outreach, history of relevance	View as spam	The alert is an AMBER alert pertaining to a child abduction in your area Over the past 6 months, you have received few alerts - 6 from the National Weather Service regarding severe weather events,1 AMBER alert, and 2 alerts from your city's EMA regarding local threats. You have not been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA. You believe that most of the prior alerts that you have received were relevant to you.	0	1	0	1		3	6	4	1	4	3	2	2	2

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	99_Type of alert	7_Frequency	3_Public awareness of WEA	20_History of relevance		A	B	C	D	E	F	G	H	I
3	Case 7: AMBER alert, many prior alerts, sufficient public outreach, history of relevance	View as spam	The alert is an AMBER alert pertaining to a child abduction in your area Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events,12 AMBER alerts, and 18 alerts from your city's EMA regarding local threats. You have previously been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA. You believe that most of the prior alerts that you have received were relevant to you.	0	0	1	1		2	2	5	1	3	1	3	2	2
	Case 8: AMBER alert, many prior alerts, insufficient public outreach, history of irrelevance	View as spam	The alert is an AMBER alert pertaining to a child abduction in your area Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events,12 AMBER alerts, and 18 alerts from your city's EMA regarding local threats. You have not been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA. You believe that most of the prior alerts that you have received were not relevant to you.	0	0	0	0		4	5	3	1	4	5	6	2	2

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	1_Relevance	21_Clarity of message spelling and grammar	44_Redundancy of alerting			A	B	C	D	E	F	G	H	I
4	Case 1: relevant, clear, unconfirmed,	View as spam	You determine that the alert <u>is relevant</u> to you (e.g., it applies to your location, it is issued in a timely manner, and it addresses an emergency that affects you). The message is <u>clear and understandable</u> with no spelling or grammar errors You can find <u>no confirmation</u> of the WEA alert information via other channels such as radio or TV news.	1	1	0			4	5	5	2	5	2	4	4	4
	Case 2: relevant, unclear, confirmed	View as spam	You determine that the alert <u>is relevant</u> to you (e.g., it applies to your location, it is issued in a timely manner, and it addresses an emergency that affects you). The message is <u>not clear</u> and contains some spelling and grammar errors You <u>can confirm</u> WEA alert information via other channels such as radio or TV news.	1	0	1			3	3	4	1	4	2	3	4	3

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	1_Relevance	21_Clarity of message spelling and grammar	44_Redundancy of alerting			A	B	C	D	E	F	G	H	I
4	Case 3: irrelevant, clear, confirmed	View as spam	You determine that the alert <u>is not relevant</u> to you (e.g., it does not apply to your location, it is not issued in a timely manner, or it does not address an emergency that affects you). The message is <u>clear and understandable</u> with no spelling or grammar errors You <u>can confirm</u> WEA alert information via other channels such as radio or TV news.	0	1	1			2	2	3	1	2	6	2	3	1
	Case 4: irrelevant, unclear, unconfirmed	View as spam	You determine that the alert <u>is not relevant</u> to you (e.g., it does not apply to your location, it is not issued in a timely manner, or it does not address an emergency that affects you). The message is <u>not clear</u> and contains some spelling and grammar errors You can find <u>no confirmation</u> of the WEA alert information via other channels such as radio or TV news.	0	0	0			7	7	6	4	7	7	7	6	5

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	coordinated	44_Redundancy of alerting	48_ Alerts viewed as spam			A	B	C	D	E	F	G	H	I
5	Case 1: coordinated alerts, confirmed, considered spam	Opt out	The two alerts appear to be coordinated, or contain the same information. You can confirm alert information via other channels such as radio or TV news. You believe that the WEA alerts are spam.	1	1	0			5	3	4	2	4	2	3	6	2
	Case 2: coordinated alerts, unconfirmed, not considered spam	Opt out	The two alerts appear to be coordinated, or contain the same information. You can find no confirmation of the alert information via other channels such as radio or TV news. You believe that the WEA alerts are not spam.	1	0	1			3	2	3	3	3	1	3	2	2
	Case 3: uncoordinated alerts, confirmed, not considered spam	Opt out	The two alerts are uncoordinated, and do not agree. You can confirm alert information via other channels such as radio or TV news. You believe that the WEA alerts are not spam.	0	1	1			3	2	4	1	3	1	3	2	1
	Case 4: uncoordinated alerts, unconfirmed, considered spam	Opt out	The two alerts are uncoordinated, and do not agree. You can find no confirmation of the alert information via other channels such as radio or TV news. You believe that the WEA alerts are spam.	0	0	0			5	4	5	3	3	6	6	6	4

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	55_Local jurisdictions act uncoordinated	21_Clarity of message spelling and grammar	71_Message in primary language	15_Easy add'l follow-us mechanisms		A	B	C	D	E	F	G	H	I
6	Case 1: coordinated alerts, clear message, in primary language, "follow us" mechanisms present	Understand	The two alerts appear to be coordinated, or contain the same information. The messages are clear and understandable with no spelling or grammar errors The messages are written in your primary language The EMAs have alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.	1	1	1	1		7	7	6	7	7	7	7	7	7
	Case 2: coordinated alerts, clear message, not in primary language, "follow us" mechanisms absent	Understand	The two alerts appear to be coordinated, or contain the same information. The messages are clear and understandable with no spelling or grammar errors The messages are issued in a language that you understand, but one that is not your primary language. The EMAs have no alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.	1	1	0	0		5	7	4	7	5	6	6	6	7

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	55_Local jurisdictions act uncoordinated	21_Clarity of message spelling and grammar	71_Message in primary language	15_Easy add'l follow-us mechanisms		A	B	C	D	E	F	G	H	I
6	Case 3: coordinated alerts, unclear message, in primary language, "follow us" mechanisms absent	Understand	The two alerts appear to be coordinated, or contain the same information. The messages are not clear and contain some spelling and grammar errors The messages are written in your primary language The EMAs have no alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.	1	0	1	0		5	6	4	4	5	5	5	4	6
	Case 4: coordinated alerts, unclear message, not in primary language, "follow us" mechanisms present	Understand	The two alerts appear to be coordinated, or contain the same information. The messages are not clear and contain some spelling and grammar errors The messages are issued in a language that you understand, but one that is not your primary language. The EMAs have alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.	1	0	0	1		4	6	4	5	4	5	4	4	4

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	55_Local jurisdictions act uncoordinated	21_Clarity of message spelling and grammar	71_Message in primary language	15_Easy add'l follow-us mechanisms		A	B	C	D	E	F	G	H	I
6	Case 5: uncoordinated alerts, clear message, in primary language, "follow us" mechanisms absent	Understand	The two alerts are uncoordinated, and do not agree. The messages are clear and understandable with no spelling or grammar errors The messages are written in your primary language The EMAs have no alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.	0	1	1	0		7	6	3	4	5	4	4	4	2
	Case 6: uncoordinated alerts, clear message, not in primary language, "follow us" mechanisms present	Understand	The two alerts are uncoordinated, and do not agree. The messages are clear and understandable with no spelling or grammar errors The messages are issued in a language that you understand, but one that is not your primary language. The EMAs have alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.	0	1	0	1		6	6	4	4	5	4	4	4	4

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	55_Local jurisdictions act uncoordinated	21_Clarity of message spelling and grammar	71_Message in primary language	15_Easy add'l follow-us mechanisms		A	B	C	D	E	F	G	H	I
6	Case 7: uncoordinated alerts, unclear message, in primary language, "follow us" mechanisms present	Understand	The two alerts are uncoordinated, and do not agree. The messages are not clear and contain some spelling and grammar errors The messages are written in your primary language The EMAs have alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.	0	0	1	1		4	5	3	4	4	4	4	4	4
	Case 8: uncoordinated alerts, unclear message, not in primary language, "follow us" mechanisms absent	Understand	The two alerts are uncoordinated, and do not agree. The messages are not clear and contain some spelling and grammar errors The messages are issued in a language that you understand, but one that is not your primary language. The EMA has no alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.	0	0	0	0		4	5	2	4	3	2	2	2	2

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	30_Explain what has happened	70_Explain why I should act	1_Relevance	21_Clarity of message spelling and grammar	37_Confirmation via social media	A	B	C	D	E	F	G	H	I
7	Case 1: includes "what," includes "why," relevant, clear message, not confirmed via social media	Believe	"Nuclear plant radiation release in this area Take shelter now to avoid radiation exposure" You determine that the alert <u>is relevant</u> to you (e.g., it applies to your location, it is issued in a timely manner, and it addresses an emergency that affects you). You <u>cannot find confirmation</u> of the information on social media (e.g., Twitter, Facebook)	1	1	1	1	0	5	6	4	7	6	6	5	6	6
	Case 2: includes "what," includes "why," irrelevant, unclear message, confirmed via social media	Believe	"Nucular plant radiatin releese in this area Take sheltar now to avoid radiatin expossur" You determine that the alert <u>is not relevant</u> to you (e.g., it does not apply to your location, it is not issued in a timely manner, or it does not address an emergency that affects you). You <u>can find confirmation</u> of the information on social media (e.g., Twitter, Facebook)	1	1	0	0	1	5	3	3	7	5	6	4	3	2

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	30_Explain what has happened	70_Explain why I should act	1_Relevance	21_Clarity of message spelling and grammar	37_Confirmation via social media	A	B	C	D	E	F	G	H	I
7	Case 3: includes "what," omits "why," relevant, unclear message, confirmed via social media	Believe	"Nucular plant radiatin releese in this area Take sheltar now" You determine that the alert is relevant to you (e.g., it applies to your location, it is issued in a timely manner, and it addresses an emergency that affects you). You can find confirmation of the information on social media (e.g., Twitter, Facebook)	1	0	1	0	1	4	5	5	5	6	6	4	5	3
	Case 4: includes "what," omits "why," irrelevant, clear message, unconfirmed via social media	Believe	"Nuclear plant radiation release in this area Take shelter now" You determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, or it does not address an emergency that affects you). You cannot find confirmation of the information on social media (e.g., Twitter, Facebook)	1	0	0	1	0	4	4	4	6	4	5	3	4	5

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	30_Explain what has happened	70_Explain why I should act	1_Relevance	21_Clarity of message spelling and grammar	37_Confirmation via social media	A	B	C	D	E	F	G	H	I
7	Case 5: omits “what,” includes “why,” relevant, unclear message, unconfirmed via social media	Believe	“Nucular power plant warnign in this area Take sheltar now to avoid radiatin expossur” You determine that the alert <u>is relevant</u> to you (e.g., it applies to your location, it is issued in a timely manner, and it addresses an emergency that affects you). You <u>cannot find confirmation</u> of the information on social media (e.g., Twitter, Facebook)	0	1	1	0	0	3	3	4	6	4	5	2	3	3
	Case 6: omits “what,” includes “why,” irrelevant, clear message, confirmed via social media	Believe	“Nuclear Power plant warning in this area Take shelter now to avoid radiation exposure” You determine that the alert <u>is not relevant</u> to you (e.g., it does not apply to your location, it is not issued in a timely manner, or it does not address an emergency that affects you). You <u>can find confirmation</u> of the information on social media (e.g., Twitter, Facebook)	0	1	0	1	1	4	6	5	7	7	6	7	5	6

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	30_Explain what has happened	70_Explain why I should act	1_Relevance	21_Clarity of message spelling and grammar	37_Confirmation via social media	A	B	C	D	E	F	G	H	I
7	Case 7: omits “what,” omits “why,” relevant, clear message, confirmed via social media	Believe	“Nuclear Power plant warning in this area Take shelter now” You determine that the alert <u>is relevant</u> to you (e.g., it applies to your location, it is issued in a timely manner, and it addresses an emergency that affects you). You <u>can find confirmation</u> of the information on social media (e.g., Twitter, Facebook)	0	0	1	1	1	4	5	5	7	7	7	7	5	6
	Case 8: omits “what,” omits “why,” irrelevant, unclear message, unconfirmed via social media	Believe	“Nucular Power plant warnign in this area Take sheltar now” You determine that the alert <u>is not relevant</u> to you (e.g., it does not apply to your location, it is not issued in a timely manner, or it does not address an emergency that affects you). You <u>cannot find confirmation</u> of the information on social media (e.g., Twitter, Facebook)	0	0	0	0	0	2	2	3	4	1	2	2	3	2

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	44_Redundancy of alerting	20_History of relevance	55_Local jurisdictions act uncoordinated	3_Public awareness of WEA		A	B	C	D	E	F	G	H	I
8	Case 1: confirmed, history of relevance, coordinated, public outreach	Believe	You can confirm alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have received were relevant to you. The two alerts appear to be coordinated, or contain the same information. You have previously been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA.	1	1	1	1		7	6	6	7	7	7	7	6	7
	Case 2: confirmed, history of relevance, uncoordinated, no public outreach	Believe	You can confirm alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have received were relevant to you. The two alerts are uncoordinated, and do not agree. You have not been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.	1	1	0	0		4	5	4	6	5	6	4	5	5

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	44_Redundancy of alerting	20_History of relevance	55_Local jurisdictions act uncoordinated	3_Public awareness of WEA		A	B	C	D	E	F	G	H	I
8	Case 3: confirmed, history of irrelevance, coordinated, no public outreach	Believe	You can confirm alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have re-ceived were not relevant to you. The two alerts appear to be coordinated, or contain the same information. You have not been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.	1	0	1	0		4	6	4	7	5	3	6	3	5
	Case 4: confirmed, history of irrelevance, uncoordinated, public outreach	Believe	You can confirm alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have re-ceived were not relevant to you. The two alerts are uncoordinated, and do not agree. You have previously been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.	1	0	0	1		5	4	3	4	4	3	5	3	6

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	44_Redundancy of alerting	20_History of relevance	55_Local jurisdictions act uncoordinated	3_Public awareness of WEA		A	B	C	D	E	F	G	H	I
8	Case 5: unconfirmed, history of relevance, coordinated, no public outreach	Believe	You can find <u>no confirmation</u> of the alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have re-ceived <u>were relevant</u> to you. The two alerts appear to be <u>coordinated</u>, or contain the <u>same information</u>. You have <u>not been made aware</u> of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.	0	1	1	0		5	6	4	7	5	5	4	5	6
	Case 6: unconfirmed, history of relevance, uncoordinated, public outreach	Believe	You can find <u>no confirmation</u> of the alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have re-ceived <u>were relevant</u> to you. The two alerts are <u>uncoordinated,</u> and <u>do not agree</u>. You have previously <u>been made aware</u> of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.	0	1	0	1		4	5	4	5	5	5	3	4	5

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	44_Redundancy of alerting	20_History of relevance	55_Local jurisdictions act uncoordinated	3_Public awareness of WEA		A	B	C	D	E	F	G	H	I
8	Case 7: unconfirmed, history of irrelevance, coordinated, public outreach	Believe	You can find no confirmation of the alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have re-ceived were not relevant to you. The two alerts appear to be coordinated, or contain the same information. You have previously been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.	0	0	1	1		3	4	5	6	4	3	4	5	6
	Case 8: unconfirmed, history of irrelevance, uncoordinated, no public outreach	Believe	You can find no confirmation of the alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have re-ceived were not relevant to you. The two alerts are uncoordinated, and do not agree. You have not been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.	0	0	0	0		1	2	3	3	2	2	1	2	4

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	8_History of final communication	12_Alert source	7_Frequency	26_Where to go for more information		A	B	C	D	E	F	G	H	I
9	Case 1: final commu-nication, local alert source, few prior alerts, references for more info	Believe	Prior WEA alerts that you have received have <u>included an “all clear” message</u> after the event has been resolved? The alert addresses an imminent threat to your area and is sent by your local Emergency Management Agency Over the past 6 months, you have received <u>few alerts</u> - 6 from the National Weather Service regarding severe weather events,1 AMBER alert, and 2 alerts from your city’s EMA regarding local threats. The message <u>includes a recommendation</u> to “Check TV & Radio for more info”	1	1	1	1		4	7	5	7	6	5	7	6	7
	Case 2: final commu-nication, local alert source, many prior alerts, no references for more info	Believe	Prior WEA alerts that you have received have <u>included an “all clear” message</u> after the event has been resolved? The alert addresses an imminent threat to your area and is sent by your local Emergency Management Agency Over the past 6 months, you have received <u>many alerts</u> - 48 from the National Weather Service regarding severe weather events,12 AMBER alerts, and 18 alerts from your city’s EMA regarding local threats. The message <u>does not include a recommendation</u> to “Check TV & Radio for more info”	1	1	0	0		3	6	4	7	5	6	4	5	6

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	8_History of final communication	12_Alert source	7_Frequency	26_Where to go for more information		A	B	C	D	E	F	G	H	I
9	Case 3: final communication, national alert source, few prior alerts, no references for more info	Believe	Prior WEA alerts that you have received have included an "all clear" message after the event has been resolved? The alert addresses an imminent threat to your area and is sent by a national government agency (e.g., FBI, FEMA). Over the past 6 months, you have received few alerts - 6 from the National Weather Service regarding severe weather events,1 AMBER alert, and 2 alerts from your city's EMA regarding local threats. The message does not include a recommendation to "Check TV & Radio for more info"	1	0	1	0		3	7	5	7	3	6	5	5	6
	Case 4: final communication, national alert source, many prior alerts, references for more info	Believe	Prior WEA alerts that you have received have included an "all clear" message after the event has been resolved? The alert addresses an imminent threat to your area and is sent by a national government agency (e.g., FBI, FEMA). Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events,12 AMBER alerts, and 18 alerts from your city's EMA regarding local threats. The message includes a recommendation to "Check TV & Radio for more info"	1	0	0	1		6	7	5	7	5	7	5	6	7

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	8_History of final communication	12_Alert source	7_Frequency	26_Where to go for more information		A	B	C	D	E	F	G	H	I
9	Case 5: no final communication, local alert source, few prior alerts, no references for more info	Believe	Prior WEA alerts that you have received have not included an “all clear” message after the event has been resolved? The alert addresses an imminent threat to your area and is sent by your local Emergency Management Agency Over the past 6 months, you have received few alerts - 6 from the National Weather Service regarding severe weather events,1 AMBER alert, and 2 alerts from your city’s EMA regarding local threats. The message does not include a recommendation to “Check TV & Radio for more info”	0	1	1	0		3	5	4	7	4	5	5	5	6
	Case 6: no final communication, local alert source, many prior alerts, references for more info	Believe	Prior WEA alerts that you have received have not included an “all clear” message after the event has been resolved? The alert addresses an imminent threat to your area and is sent by your local Emergency Management Agency Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events,12 AMBER alerts, and 18 alerts from your city’s EMA regarding local threats. The message includes a recommendation to “Check TV & Radio for more info”	0	1	0	1		4	6	5	7	6	6	6	5	7

Scenarios				Factors					Responses								
#	Case	Target Node	Scenario Description	8_History of final communication	12_Alert source	7_Frequency	26_Where to go for more information		A	B	C	D	E	F	G	H	I
9	Case 7: no final communication, national alert source, few prior alerts, references for more info	Believe	Prior WEA alerts that you have received have not included an "all clear" message after the event has been resolved? The alert addresses an imminent threat to your area and is sent by a national government agency (e.g., FBI, FEMA). Over the past 6 months, you have received few alerts - 6 from the National Weather Service regarding severe weather events,1 AMBER alert, and 2 alerts from your city's EMA regarding local threats. The message includes a recommendation to "Check TV & Radio for more info"	0	0	1	1		3	6	5	7	5	5	6	6	7
9	Case 8: no final communication, national alert source, many prior alerts, no references for more info	Believe	Prior WEA alerts that you have received have not included an "all clear" message after the event has been resolved? The alert addresses an imminent threat to your area and is sent by a national government agency (e.g., FBI, FEMA). Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events,12 AMBER alerts, and 18 alerts from your city's EMA regarding local threats. The message does not include a recommendation to "Check TV & Radio for more info"	0	0	0	0		4	4	4	7	2	6	4	4	6

Appendix V Public Trust Model Validation Survey

TRUST MODEL VALIDATION SCENARIOS

Scenario 1. ***This set of scenarios probes the impact of an alert message's specification of <u>what has happened</u>, <u>who should act</u>, and <u>why they should act</u> on your interpretation of the alert.***

Your city's Emergency Management Agency (EMA) has been using WEA to alert the public to imminent threats for the past 12 months. From public service announcements on the TV news and in the newspapers, you are aware of what the WEA service is and how it is used. You have received several WEA alerts on you mobile phone over the past year.

For each of the cases below, please indicate how likely you are to consider the received alert as being relevant to you.

Case 1: ***specifies "what has happened", omits "who should act", specifies "why they should act"***

You are in ZIP code 12345 at 4:37 PM, when your mobile phone receives and displays the following alert
"Nuclear plant radiation release
in this area
Take shelter now
to avoid radiation exposure"

How likely are you to consider this alert to be relevant to you? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 2: ***specifies "what has happened", specifies "who should act", omits "why they should act"***

You are in ZIP code 12345 at 4:37 PM, when your mobile phone receives and displays the following alert *"Nuclear plant radiation release* *in ZIP 12345* *Take shelter now"*

How likely are you to consider this alert to be relevant to you? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 3: ***omits "what has happened", specifies "who should act", specifies "why they should act"***

You are in ZIP code 12345 at 4:37 PM, when your mobile phone receives and displays the following alert *"Nuclear power plant warning* *in ZIP 12345* *Take shelter now* *to avoid radiation exposure"*

How likely are you to consider this alert to be relevant to you? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 4: ***omits "what has happened", omits "who should act", omits "why they should act"***

You are in ZIP code 12345 at 4:37 PM, when your mobile phone receives and displays the following alert *"Nuclear power plant warning* *in this area* *Take shelter now"*

How likely are you to consider this alert to be relevant to you? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Scenario 2. ***This set of scenarios probes the impact of an alert's specification of action to take, time to act, who should act, the lead time for the alert, and the relevance of the alert on your willingness to take action.***

Your city's Emergency Management Agency (EMA) has been using WEA to alert the public to imminent threats for the past 12 months. You have received WEA alerts on you mobile phone over the past year.

For each of the cases below, please indicate how likely you are to take action in response to the alert.

Case 1: defined action, defined time, sufficient lead, includes "who," irrelevant

You are in ZIP code 12345 at 4:37 PM, when your mobile phone receives and displays the following alert
"Flash flood
in ZIP 12345
from 4:55 to 5:35 PM
Evacuate low lying areas"

You determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, it does not address an emergency that affects you).

How likely are you to take action in response to this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 2: defined action, defined time, insufficient lead, omits "who," relevant

You are in ZIP code 12345 at 4:37 PM, when your mobile phone receives and displays the following alert
"Flash flood
in this area
from 4:40 to 5:20 PM
Evacuate low lying areas"

You determine that the alert is relevant to you (e.g., it applies to your location, it is issued in a timely manner, it addresses an emergency that affects you).

How likely are you to take action in response to this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 3: defined action, undefined time, sufficient lead, omits "who," relevant

You are in ZIP code 12345 at 4:37 PM, when your mobile phone receives and displays the following alert *"Flash flood in this area at 4:55 PM Evacuate low lying areas"* You determine that the alert is relevant to you (e.g., it applies to your location, it is issued in a timely manner, it addresses an emergency that affects you).

How likely are you to take action in response to this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 4: defined action, undefined time, insufficient lead, includes "who," irrelevant

You are in ZIP code 12345 at 4:37 PM, when your mobile phone receives and displays the following alert *"Flash flood in ZIP 12345 at 4:40 PM Evacuate low lying areas"* You determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, it does not address an emergency that affects you).

How likely are you to take action in response to this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 5: undefined action, defined time, sufficient lead, omits "who," irrelevant

You are in ZIP code 12345 at 4:37 PM, when your mobile phone receives and displays the following alert *"Flash flood in this area from 4:55 to 5:35 PM"* You determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, it does not address an emergency that affects you).

How likely are you to take action in response to this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Case 6: undefined action, defined time, insufficient lead, includes "who," relevant

You are in ZIP code 12345 at 4:37 PM, when your mobile phone receives and displays the following alert *"Flash flood in ZIP 12345 from 4:40 to 5:20 PM"* You determine that the alert is relevant to you (e.g., it applies to your location, it is issued in a timely manner, it addresses an emergency that affects you).

How likely are you to take action in response to this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Case 7: undefined action, undefined time, sufficient lead, includes “who,” relevant

You are in ZIP code 12345 at 4:37 PM, when your mobile phone receives and displays the following alert
“Flash flood
in ZIP 12345
from 4:55 PM”

You determine that the alert is relevant to you (e.g., it applies to your location, it is issued in a timely manner, it addresses an emergency that affects you).

How likely are you to take action in response to this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 8: undefined action, undefined time, insufficient lead, omits “who,” irrelevant

You are in ZIP code 12345 at 4:37 PM, when your mobile phone receives and displays the following alert
“Flash flood
in this area
at 4:40 PM

You determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, it does not address an emergency that affects you).

How likely are you to take action in response to this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Scenario 3. This set of scenarios probes the impact of the type of alert, the frequency of alerts, public outreach, and the history of alert relevance on you interpretation of the alert as spam

Your city's Emergency Management Agency (EMA) has been using WEA to alert the public to imminent threats for the past 12 months. You have received WEA alerts on you mobile phone over the past year.

At 4:37 PM your mobile phone receives and displays an alert.

For each of the cases below, please indicate how likely you are to view this alert as spam

Case 1: imminent threat, few prior alerts, sufficient public outreach, history of relevance

The alert pertains to an imminent threat (i.e., a flash flood) in your area

Over the past 6 months, you have received few alerts - 6 from the National Weather Service regarding severe weather events, and 1 AMBER alert, and 2 alerts from your city's EMA regarding local threats.

You have previously been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA.

You believe that most of the prior alerts that you have received were relevant to you.

How likely you are to view this alert as spam? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 2: imminent threat, few prior alerts, insufficient public outreach, history of irrelevance

The alert pertains to an imminent threat (i.e., a flash flood) in your area

Over the past 6 months, you have received few alerts - 6 from the National Weather Service regarding severe weather events, and 1 AMBER alert, and 2 alerts from your city's EMA regarding local threats.

You have not been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA.

You believe that most of the prior alerts that you have received were not relevant to you.

How likely you are to view this alert as spam? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 3: imminent threat, many prior alerts, sufficient public outreach, history of irrelevance

The alert pertains to an imminent threat (i.e., a flash flood) in your area Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events, and 12 AMBER alerts, and 18 alerts from your city's EMA regarding local threats. You have previously been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA. You believe that most of the prior alerts that you have received were not relevant to you.

How likely you are to view this alert as spam? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 4: imminent threat, many prior alerts, insufficient public outreach, history of relevance

The alert pertains to an imminent threat (i.e., a flash flood) in your area Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events, and 12 AMBER alerts, and 18 alerts from your city's EMA regarding local threats. You have not been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA. You believe that most of the prior alerts that you have received were relevant to you.

How likely you are to view this alert as spam? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 5: AMBER alert, few alerts prior, sufficient public outreach, history of irrelevance

The alert is an AMBER alert pertaining to a child abduction in your area Over the past 6 months, you have received few alerts - 6 from the National Weather Service regarding severe weather events, and 1 AMBER alert, and 2 alerts from your city's EMA regarding local threats. You have previously been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA. You believe that most of the prior alerts that you have received were not relevant to you.

How likely you are to view this alert as spam? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 6: AMBER alert, few prior alerts, insufficient public outreach, history of relevance

The alert is an AMBER alert pertaining to a child abduction in your area Over the past 6 months, you have received few alerts - 6 from the National Weather Service regarding severe weather events, and 1 AMBER alert, and 2 alerts from your city's EMA regarding local threats. You have not been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA. You believe that most of the prior alerts that you have received were relevant to you.

How likely you are to view this alert as spam? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 7: AMBER alert, many prior alerts, sufficient public outreach, history of relevance

The alert is an AMBER alert pertaining to a child abduction in your area Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events, and 12 AMBER alerts, and 18 alerts from your city's EMA regarding local threats. You have previously been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA. You believe that most of the prior alerts that you have received were relevant to you.

How likely you are to view this alert as spam? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 8: AMBER alert, many prior alerts, insufficient public outreach, history of irrelevance

The alert is an AMBER alert pertaining to a child abduction in your area Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events, and 12 AMBER alerts, and 18 alerts from your city's EMA regarding local threats. You have not been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMA. You believe that most of the prior alerts that you have received were not relevant to you.

How likely you are to view this alert as spam? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Scenario 4. This set of scenarios probes the impact of the relevance of the alert, the clarity of the message, and the ability to confirm the alert from other sources on your interpretation of the alert as spam

Your city's Emergency Management Agency (EMA) has been using WEA to alert the public to imminent threats for the past 12 months. You have received WEA alerts on you mobile phone over the past year.

At 4:37 PM your mobile phone receives and displays an alert.

For each of the following cases, please indicate how likely you are to view this alert as spam.

Case 1: relevant, clear, unconfirmed,

You determine that the alert is relevant to you (e.g., it applies to your location, it is issued in a timely manner, it addresses an emergency that affects you). The message is clear and understandable with no spelling or grammar errors You can find no confirmation of the WEA alert information via other channels such as radio or TV news.

How likely are you to view this alert as spam? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 2: relevant, unclear, confirmed

You determine that the alert is relevant to you (e.g., it applies to your location, it is issued in a timely manner, it addresses an emergency that affects you). The message is not clear and contains some spelling and grammar errors You can confirm the WEA alert information via other channels such as radio or TV news.

How likely are you to view this alert as spam? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 3: irrelevant, clear, confirmed

You determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, it does not address an emergency that affects you). The message is clear and understandable with no spelling or grammar errors You can confirm WEA alert information via other channels such as radio or TV news.

How likely are you to view this alert as spam? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 4: irrelevant, unclear, unconfirmed

You determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, it does not address an emergency that affects you). The message is not clear and contains some spelling and grammar errors You can find no confirmation of the WEA alert information via other channels such as radio or TV news.

How likely are you to view this alert as spam? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Scenario 5. This set of scenarios probes the impact of the coordination of alerts across multiple jurisdictions, the ability to confirm the alert from other sources , and your interpretation of the alert as spam on your willingness to opt out of the WEA service

Your city's Emergency Management Agency (EMA) and your county EMA have both been using WEA to alert the public to imminent threats for the past 12 months. From public service announcements on the TV news and in the newspapers, you are aware of what the WEA service is and how it is used. You have received several WEA alerts on you mobile phone over the past year.

At 4:37 PM your mobile phone receives and displays an alert from your city EMA regarding an imminent threat (i.e., a flash flood) in your area. At 4:48 your mobile phone receives and displays an alert from your county EMA regarding the same emergency.

For each of the following cases, please indicate how likely you are to opt out of the WEA service.

Case 1: coordinated alerts, confirmed, considered spam

The two alerts appear to be coordinated, or contain the same information. You can confirm alert information via other channels such as radio or TV news. You believe that the WEA alerts are spam.

How likely are you to opt out of the WEA service? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 2: coordinated alerts, unconfirmed, not considered spam

The two alerts appear to be coordinated, or contain the same information. You can find no confirmation of the alert information via other channels such as radio or TV news. You believe that the WEA alerts are not spam.

How likely are you to opt out of the WEA service? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 3: uncoordinated alerts, confirmed, not considered spam

The two alerts are uncoordinated, and do not agree. You can confirm alert information via other channels such as radio or TV news. You believe that the WEA alerts are not spam.

How likely are you to opt out of the WEA service? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Case 4: uncoordinated alerts, unconfirmed, considered spam

The two alerts are uncoordinated, and do not agree. You can find no confirmation of the alert information via other channels such as radio or TV news. You believe that the WEA alerts are spam.

How likely are you to opt out of the WEA service? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Scenario 6. This set of scenarios probes the impact of the coordination of alerts across multiple jurisdictions, the message clarity, the message language , and alternate communications channels on your ability to understand an alert

Your city's Emergency Management Agency (EMA) has been using WEA to alert the public to imminent threats for the past 12 months. You have received WEA alerts on you mobile phone over the past year.

At 4:37 PM your mobile phone receives and displays an alert from your city EMA regarding an imminent threat (i.e., a flash flood) in your area. At 4:48 your mobile phone receives and displays an alert from your county EMA regarding the same emergency.

For each of the following cases, please indicate how likely you are to understand the alerts.

Case 1: coordinated alerts, clear message, in primary language, "follow us" mechanisms present

The two alerts appear to be coordinated, or contain the same information.
The messages are clear and understandable with no spelling or grammar errors
The messages are written in your primary language
The EMAs have alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.

How likely are you to understand these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Case 2: coordinated alerts, clear message, not in primary language, "follow us" mechanisms absent

The two alerts appear to be coordinated, or contain the same information. The messages are clear and understandable with no spelling or grammar errors The messages are issued in a language that you understand, but one that is not your primary language. The EMAs have no alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.

How likely are you to understand these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 3: coordinated alerts, unclear message, in primary language, "follow us" mechanisms absent

The two alerts appear to be coordinated, or contain the same information. The messages are not clear and contain some spelling and grammar errors The messages are written in your primary language The EMAs have no alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.

How likely are you to understand these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 4: coordinated alerts, unclear message, not in primary language, "follow us" mechanisms present

The two alerts appear to be coordinated, or contain the same information. The messages are not clear and contain some spelling and grammar errors The messages are issued in a language that you understand, but one that is not your primary language. The EMAs have alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.

How likely are you to understand these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 5: uncoordinated alerts, clear message, in primary language, "follow us" mechanisms absent

The two alerts are uncoordinated, and do not agree. The messages are clear and understandable with no spelling or grammar errors The messages are written in your primary language The EMAs have no alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.

How likely are you to understand these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 6: uncoordinated alerts, clear message, not in primary language, "follow us" mechanisms present

The two alerts are uncoordinated, and do not agree. The messages are clear and understandable with no spelling or grammar errors The messages are issued in a language that you understand, but one that is not your primary language. The EMAs have alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.

How likely are you to understand these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 7: uncoordinated alerts, unclear message, in primary language, "follow us" mechanisms present

The two alerts are uncoordinated, and do not agree. The messages are not clear and contain some spelling and grammar errors The messages are written in your primary language The EMAs have alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.

How likely are you to understand these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 8: uncoordinated alerts, unclear message, not in primary language, “follow us” mechanisms absent

The two alerts are uncoordinated, and do not agree. The messages are not clear and contain some spelling and grammar errors The messages are issued in a language that you understand, but one that is not your primary language. The EMAs have no alternate communications channels (e.g., web site, Facebook page, Twitter account) that you can access easily.

How likely are you to understand these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Scenario 7. This set of scenarios probes the impact of an alert message's specification of what has happened and why you should act, the relevance of the message, the message clarity, and the ability to confirm via social media on your willingness to believe an alert.

Your city's Emergency Management Agency (EMA) has been using WEA to alert the public to imminent threats for the past 12 months. You have received WEA alerts on you mobile phone over the past year.

At 4:37 PM your mobile phone receives and displays an alert.

For each of the following cases, please indicate how likely you are to believe this alert.

Case 1: includes "what," includes "why," relevant, clear message, not confirmed via social media

"Nuclear plant radiation release
in this area
Take shelter now
to avoid radiation exposure"

You determine that the alert is relevant to you (e.g., it applies to your location, it is issued in a timely manner, it addresses an emergency that affects you).

You cannot find confirmation of the information on social media (e.g., Twitter, Facebook)

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 2: includes “what,” includes “why,” irrelevant, unclear message, confirmed via social media

“Nucular plant radiatin releese *in this area* *Take sheltar now* *to avoid radiatin expossur”* You determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, it does not address an emergency that affects you). You can find confirmation of the information on social media (e.g., Twitter, Facebook)

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 3: includes “what,” omits “why,” relevant, unclear message, confirmed via social media

“Nucular plant radiatin releese *in this area* *Take sheltar now”* You determine that the alert is relevant to you (e.g., it applies to your location, it is issued in a timely manner, it addresses an emergency that affects you). You can find confirmation of the information on social media (e.g., Twitter, Facebook)

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 4: includes “what,” omits “why,” irrelevant, clear message, unconfirmed via social media

“Nuclear plant radiation release *in this area* *Take shelter now”* You determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, it does not address an emergency that affects you). You cannot find confirmation of the information on social media (e.g., Twitter, Facebook)

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Case 5: omits "what," includes "why," relevant, unclear message, unconfirmed via social media

"Nucular power plant warnign
in this area
Take sheltar now
to avoid radiatin expossur"

You determine that the alert is relevant to you (e.g., it applies to your location, it is issued in a timely manner, it addresses an emergency that affects you).

You cannot find confirmation of the information on social media (e.g., Twitter, Facebook)

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Case 6: omits "what," includes "why," irrelevant, clear message, confirmed via social media

"Nuclear Power plant warning
in this area
Take shelter now
to avoid radiation exposure"

You determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, it does not address an emergency that affects you).

You can find confirmation of the information on social media (e.g., Twitter, Facebook)

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Case 7: omits "what," omits "why," relevant, clear message, confirmed via social media

> *"Nuclear Power plant warning*
> *in this area*
> *Take shelter now"*
>
> You determine that the alert is relevant to you (e.g., it applies to your location, it is issued in a timely manner, it addresses an emergency that affects you).
>
> You can find confirmation of the information on social media (e.g., Twitter, Facebook)

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Case 8: omits "what," omits "why," irrelevant, unclear message, unconfirmed via social media

> *"Nucular Power plant warnign*
> *in this area*
> *Take sheltar now"*
>
> You determine that the alert is not relevant to you (e.g., it does not apply to your location, it is not issued in a timely manner, it does not address an emergency that affects you).
>
> You cannot find confirmation of the information on social media (e.g., Twitter, Facebook)

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Scenario 8. This set of scenarios probes the impact of the ability to confirm the alert from other sources, the history of relevance of prior alerts, coordination of alerts across multiple jurisdictions, and public outreach on your willingness to believe an alert.

Your city's Emergency Management Agency (EMA) has been using WEA to alert the public to imminent threats for the past 12 months. You have received WEA alerts on you mobile phone over the past year.

At 4:37 PM your mobile phone receives and displays an alert from your city EMA regarding an imminent threat (i.e., a flash flood) in your area. At 4:48 your mobile phone receives and displays an alert from your county EMA regarding the same emergency.

For each of the following cases, please indicate how likely you are to believe these alerts.

Case 1: confirmed, history of relevance, coordinated, public outreach

You can confirm alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have received were relevant to you. The two alerts appear to be coordinated, or contain the same information. You have previously been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.

How likely are you to believe these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 2: confirmed, history of relevance, uncoordinated, no public outreach

You can confirm alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have received were relevant to you. The two alerts are uncoordinated, and do not agree. You have not been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.

How likely are you to believe these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 3: confirmed, history of irrelevance, coordinated, no public outreach

You can confirm alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have received were not relevant to you. The two alerts appear to be coordinated, or contain the same information. You have not been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.

How likely are you to believe these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 4: confirmed, history of irrelevance, uncoordinated, public outreach

You can confirm alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have received were not relevant to you. The two alerts are uncoordinated, and do not agree. You have previously been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.

How likely are you to believe these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 5: unconfirmed, history of relevance, coordinated, no public outreach

You can find no confirmation of the alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have received were relevant to you. The two alerts appear to be coordinated, or contain the same information. You have not been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.

How likely are you to believe these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Case 6: unconfirmed, history of relevance, uncoordinated, public outreach

You can find no confirmation of the alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have received were relevant to you. The two alerts are uncoordinated, and do not agree. You have previously been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.

How likely are you to believe these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Case 7: unconfirmed, history of irrelevance, coordinated, public outreach

You can find no confirmation of the alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have received were not relevant to you. The two alerts appear to be coordinated, or contain the same information. You have previously been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.

How likely are you to believe these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 8: unconfirmed, history of irrelevance, uncoordinated, no public outreach

You can find no confirmation of the alert information via other channels such as radio or TV news. You believe that most of the prior alerts that you have received were not relevant to you. The two alerts are uncoordinated, and do not agree. You have not been made aware of the WEA program via public outreach (e.g., newspaper articles, mobile service provider mailings, TV and radio news stories) from the EMAs.

How likely are you to believe these alerts? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Scenario 9. ***This set of scenarios probes the impact of the issuance of a final "all clear" alert, the source of the alert, the frequency of alerts, and provision of references for more information on your willingness to believe an alert.***

Your city's Emergency Management Agency (EMA) has been using WEA to alert the public to imminent threats for the past 12 months. You have received WEA alerts on you mobile phone over the past year.

At 4:37 PM your mobile phone receives and displays an alert regarding an imminent threat (i.e., a flash flood) in your area.

For each of the following cases, please indicate how likely you are to believe this alert.

Case 1: final communication, local alert source, few prior alerts, references for more info

Prior WEA alerts that you have received have included an "all clear" message after the event has been resolved? The alert addresses an imminent threat to your area and is sent by your local Emergency Management Agency Over the past 6 months, you have received few alerts - 6 from the National Weather Service regarding severe weather events, and 1 AMBER alert, and 2 alerts from your city's EMA regarding local threats. The message includes a recommendation to "Check TV & Radio for more info"

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Case 2: final communication, local alert source, many prior alerts, no references for more info

Prior WEA alerts that you have received have included an "all clear" message after the event has been resolved? The alert addresses an imminent threat to your area and is sent by your local Emergency Management Agency Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events, and 12 AMBER alerts, and 18 alerts from your city's EMA regarding local threats. The message does not include a recommendation to "Check TV & Radio for more info"

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 3: final communication, national alert source, few prior alerts, no references for more info

Prior WEA alerts that you have received have included an "all clear" message after the event has been resolved? The alert addresses an imminent threat to your area and is sent by a national government agency (e.g., FBI, DHS, FEMA). Over the past 6 months, you have received few alerts - 6 from the National Weather Service regarding severe weather events, and 1 AMBER alert, and 2 alerts from your city's EMA regarding local threats. The message does not include a recommendation to "Check TV & Radio for more info"

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 4: final communication, national alert source, many prior alerts, references for more info

Prior WEA alerts that you have received have included an “all clear” message after the event has been resolved? The alert addresses an imminent threat to your area and is sent by a national government agency (e.g., FBI, DHS, FEMA). Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events, and 12 AMBER alerts, and 18 alerts from your city’s EMA regarding local threats. The message includes a recommendation to “Check TV & Radio for more info”

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 5: no final communication, local alert source, few prior alerts, no references for more info

Prior WEA alerts that you have received have not included an “all clear” message after the event has been resolved? The alert addresses an imminent threat to your area and is sent by your local Emergency Management Agency Over the past 6 months, you have received few alerts - 6 from the National Weather Service regarding severe weather events, and 1 AMBER alert, and 2 alerts from your city’s EMA regarding local threats. The message does not include a recommendation to “Check TV & Radio for more info”

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 6: no final communication, local alert source, many prior alerts, references for more info

Prior WEA alerts that you have received have not included an "all clear" message after the event has been resolved? The alert addresses an imminent threat to your area and is sent by your local Emergency Management Agency Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events, and 12 AMBER alerts, and 18 alerts from your city's EMA regarding local threats. The message includes a recommendation to "Check TV & Radio for more info"

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 7: no final communication, national alert source, few prior alerts, references for more info

Prior WEA alerts that you have received have not included an "all clear" message after the event has been resolved? The alert addresses an imminent threat to your area and is sent by a national government agency (e.g., FBI, DHS, FEMA). Over the past 6 months, you have received few alerts - 6 from the National Weather Service regarding severe weather events, and 1 AMBER alert, and 2 alerts from your city's EMA regarding local threats. The message includes a recommendation to "Check TV & Radio for more info"

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 8: no final communication, national alert source, many prior alerts, no references for more info

Prior WEA alerts that you have received have not included an “all clear” message after the event has been resolved? The alert addresses an imminent threat to your area and is sent by a national government agency (e.g., FBI, DHS, FEMA). Over the past 6 months, you have received many alerts - 48 from the National Weather Service regarding severe weather events, and 12 AMBER alerts, and 18 alerts from your city’s EMA regarding local threats. The message does not include a recommendation to “Check TV & Radio for more info”

How likely are you to believe this alert? (Please choose one)

☐	☐	☐	☐	☐	☐	☐
Definitely Not	Very Probably Not	Probably Not	Maybe	Probably	Very Probably	Definitely
(<5%)	(5-20%)	(20-40%)	(40-60%)	(60-80%)	(80-95%)	(>95%)

Appendix W Public Trust Model Validation Graphical Results

In each figure, the vertical axis shows the number of respondents who chose a particular answer. The horizontal axis refers to the answer selected by the respondents: 1 = Definitely Not, 2 = Very Probably Not, 3 = Probably Not, 4 = Maybe, 5 = Probably, 6 = Very Probably, 7 = Definitely.

Scenario 1

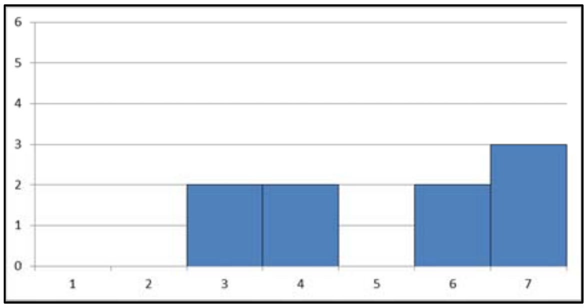

Figure 45: Case 1: Includes “What” and “Why” and Omits “Who”

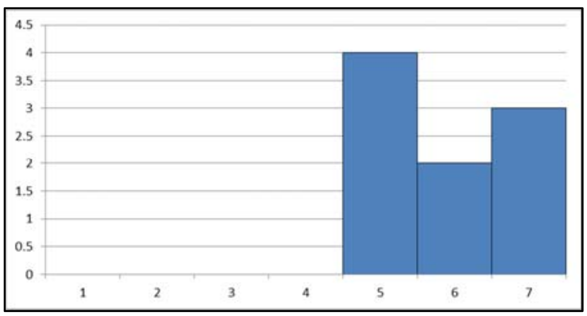

Figure 46: Case 2: Includes “What,” Omits “Why,” and Includes “Who”

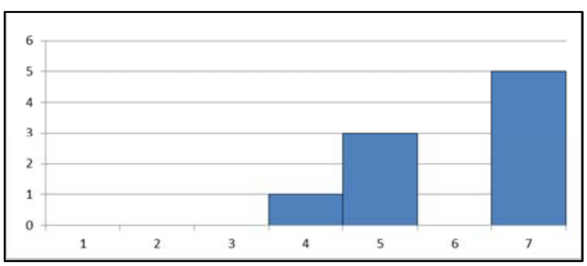

Figure 47: Case 3: Omits “What” and Includes “Why” and “Who”

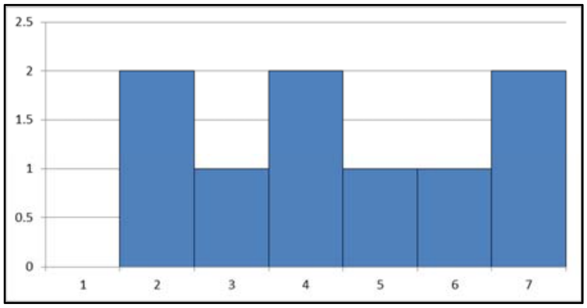

Figure 48: Case 4: Omits "What," "Why," and "Who"

Scenario 2

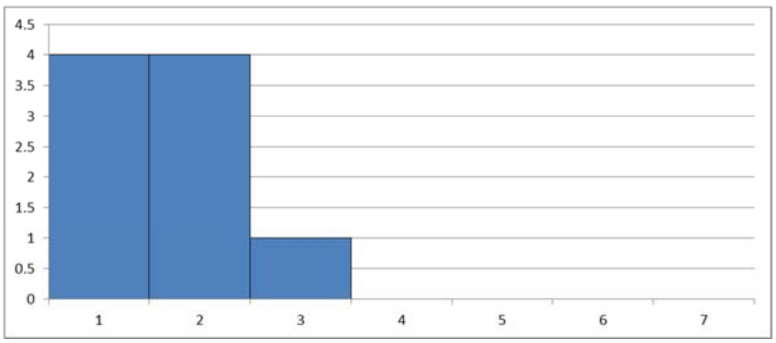

Figure 49: Case 1: Defined Action and Time, Sufficient Lead, Includes "Who," and Irrelevant

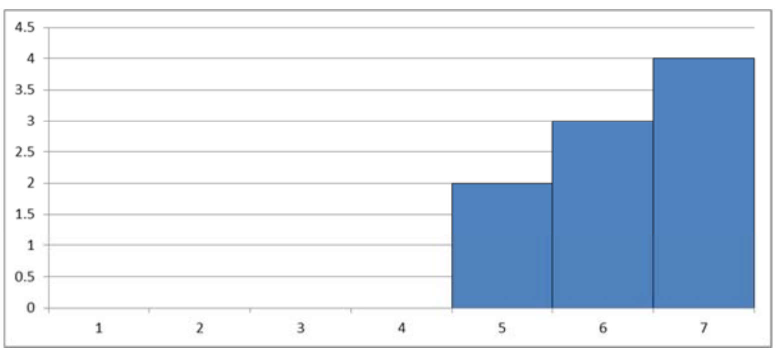

Figure 50: Case 2: Defined Action and Time, Insufficient Lead, Omits "Who," and Relevant

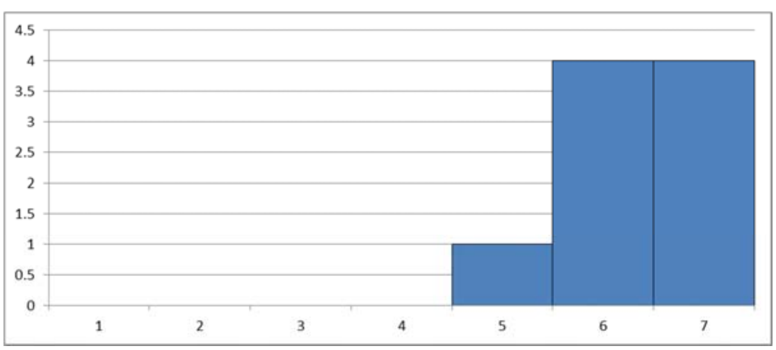

Figure 51: Case 3: Defined Action, Undefined Time, Sufficient Lead, Omits "Who," and Relevant

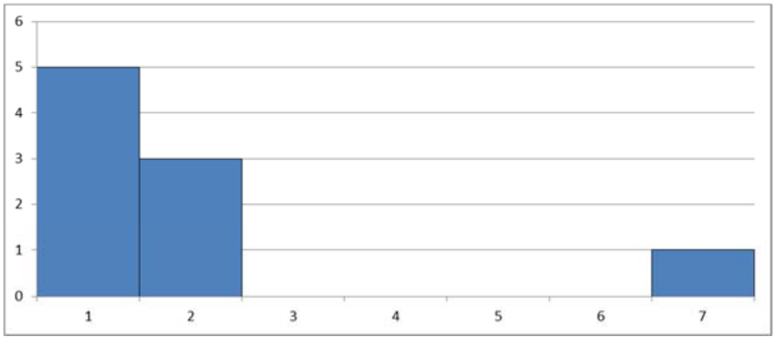

Figure 52: Case 4: Defined Action, Undefined Time, Insufficient Lead, Includes "Who," and Irrelevant

Scenario 3

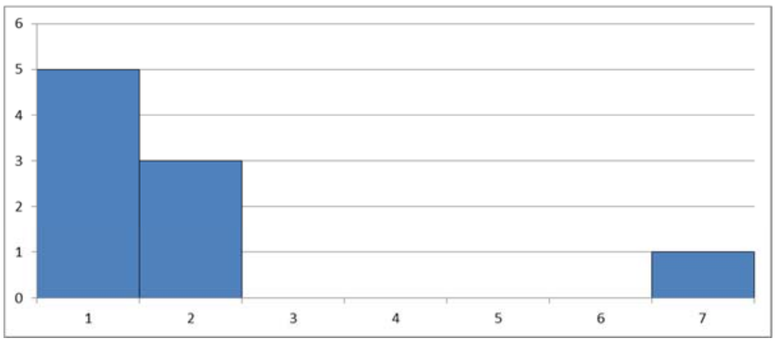

Figure 53: Case 5: Undefined Action, Defined Time, Sufficient Lead, Omits "Who," and Irrelevant

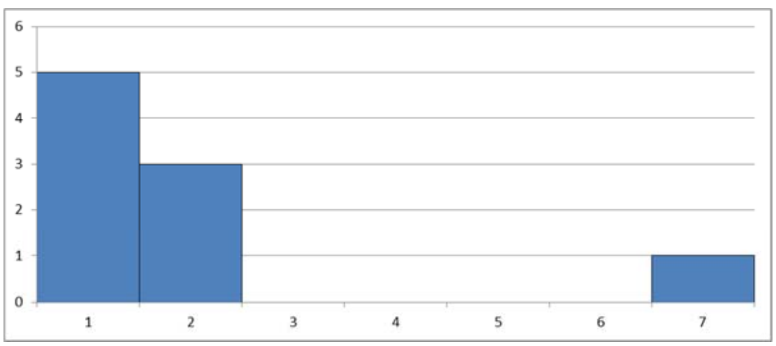

Figure 54: Case 6: Undefined Action, Defined Time, Insufficient Lead, Includes "Who," and Relevant

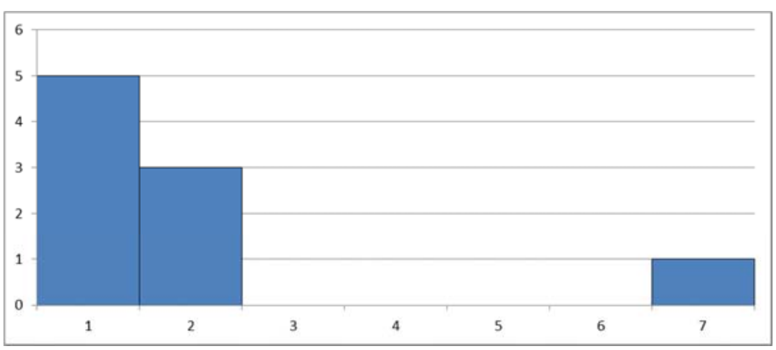

Figure 55: Case 7: Undefined Action and Time, Sufficient Lead, Includes "Who," and Relevant

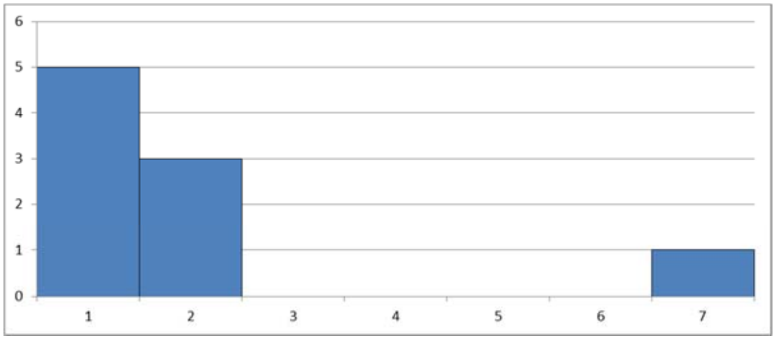

Figure 56: Case 8: Undefined Action and Time, Insufficient Lead, Omits “Who,” and Irrelevant

Scenario 3

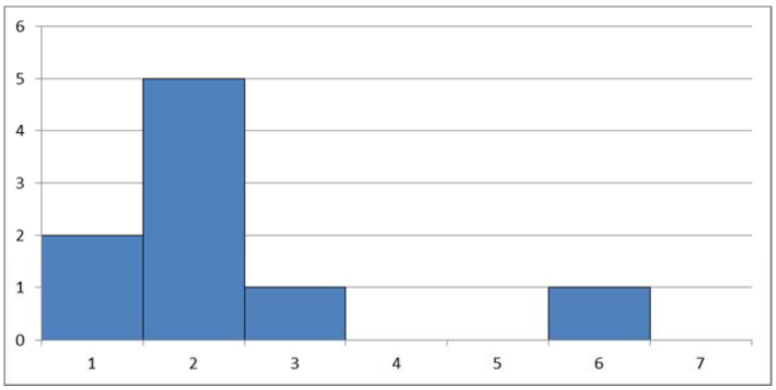

Figure 57: Case 1: Imminent Threat, Few Prior Alerts, Sufficient Public Outreach, and History of Relevance

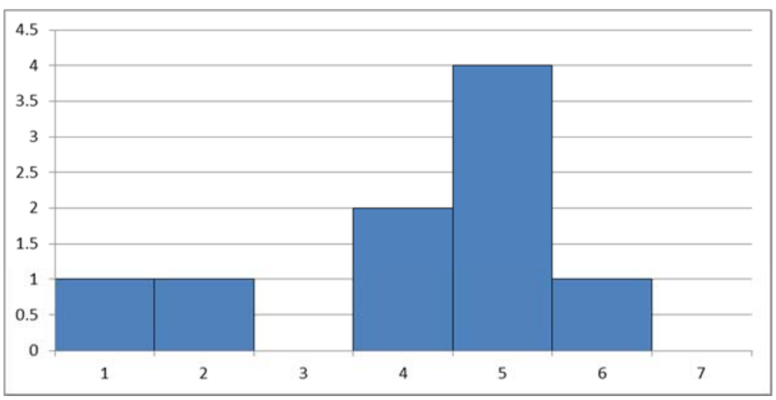

Figure 58: Case 2: Imminent Threat, Few Prior Alerts, Insufficient Public Outreach, and History of Irrelevance

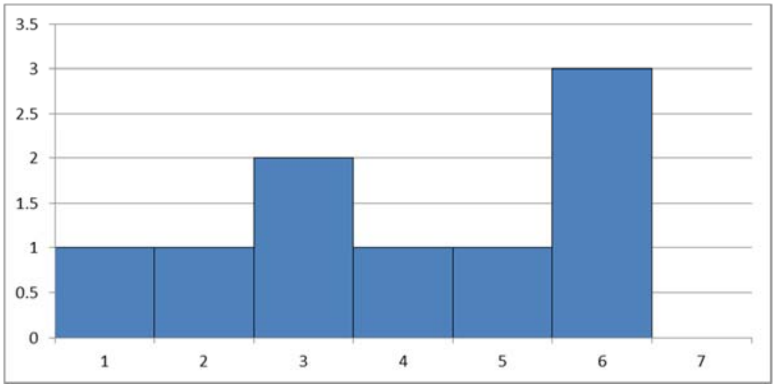

Figure 59: Case 3: Imminent Threat, Many Prior Alerts, Sufficient Public Outreach, and History of Irrelevance

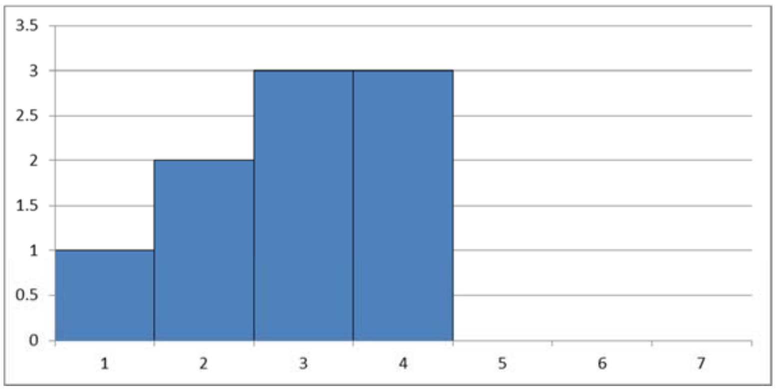

Figure 60: Case 4: Imminent Threat, Many Prior Alerts, Insufficient Public Outreach, and History of Relevance

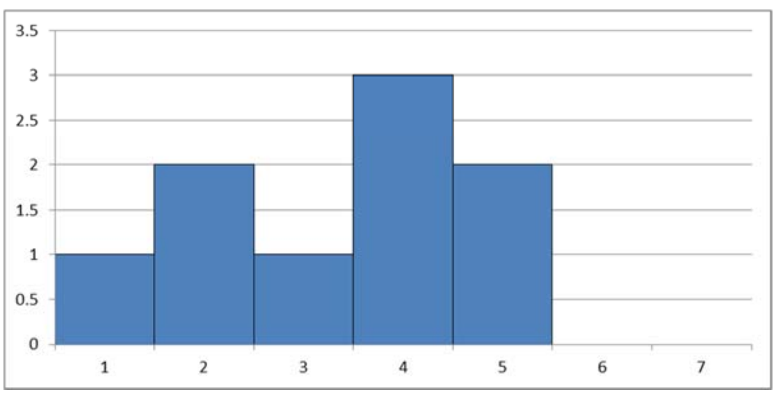

Figure 61: Case 5: AMBER Alert, Few Prior Alerts, Sufficient Public Outreach, and History of Irrelevance

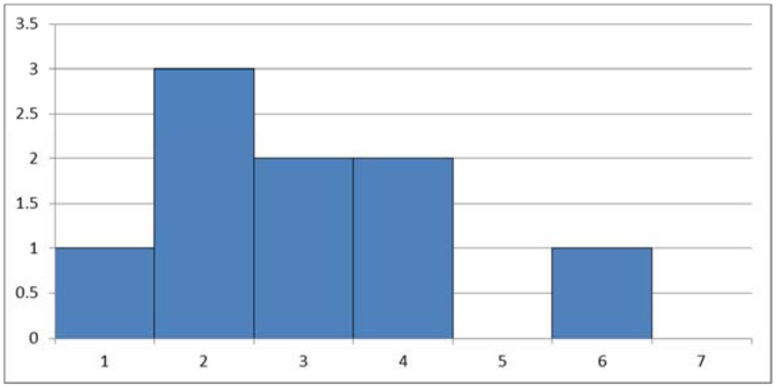

Figure 62: Case 6: AMBER Alert, Few Prior Alerts, Insufficient Public Outreach, and History of Relevance

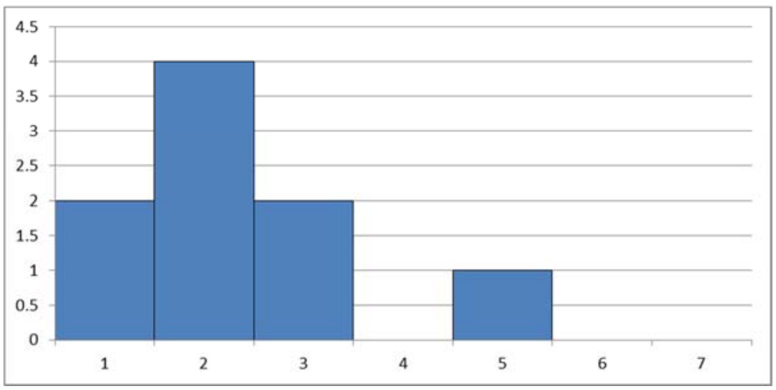

Figure 63: Case 7: AMBER Alert, Many Prior Alerts, Sufficient Public Outreach, and History of Relevance

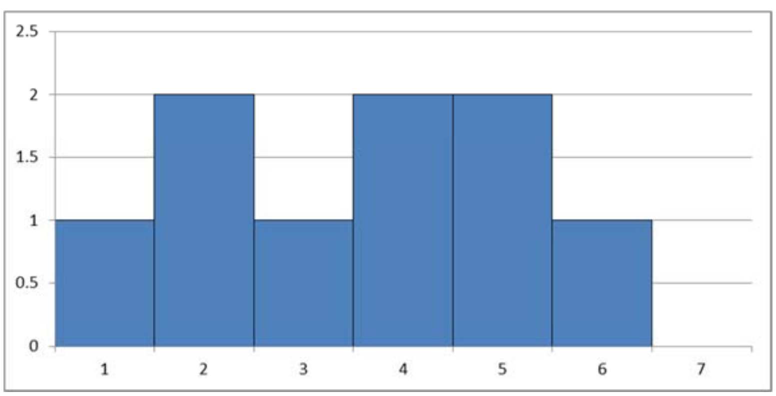

Figure 64: Case 8: AMBER Alert, Many Prior Alerts, Insufficient Public Outreach, and History of Irrelevance

Scenario 4

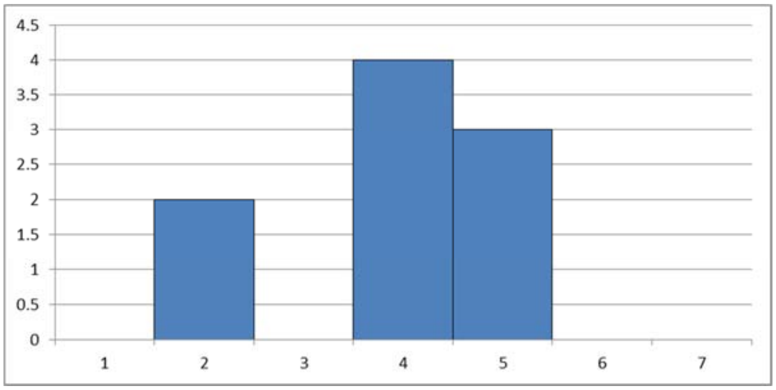

Figure 65: Case 1: Relevant, Clear, and Unconfirmed

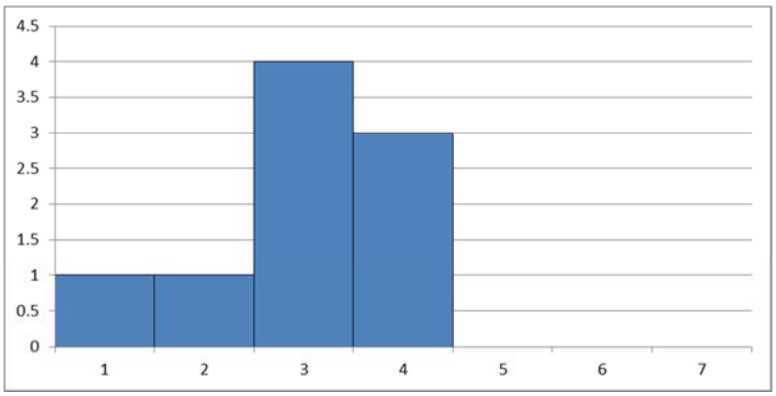

Figure 66: Case 2: Relevant, Unclear, and Confirmed

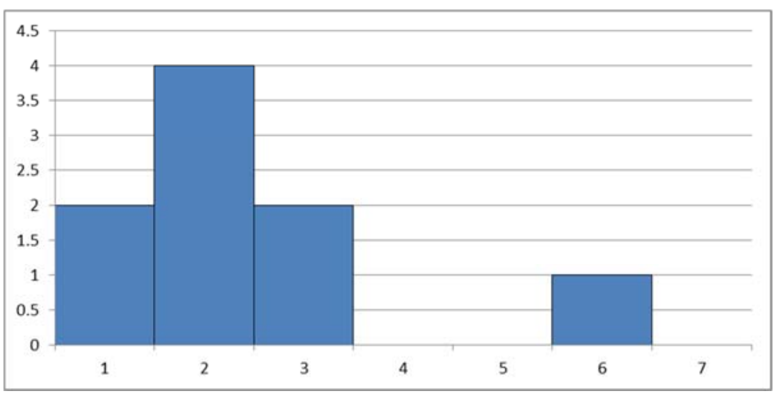

Figure 67: Case 3: Irrelevant, Clear, and Confirmed

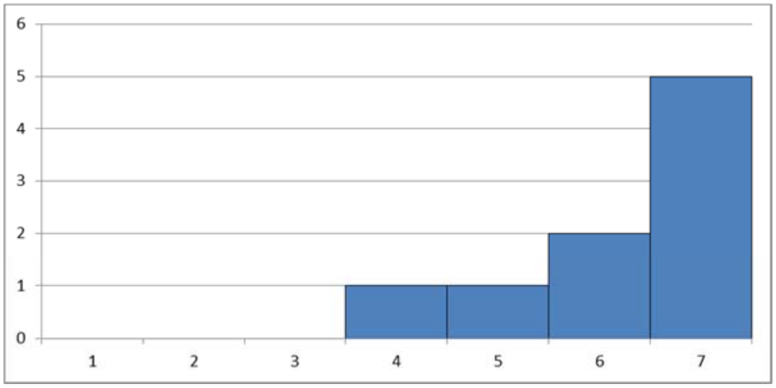

Figure 68: Case 4: Irrelevant, Unclear, and Unconfirmed

Scenario 5

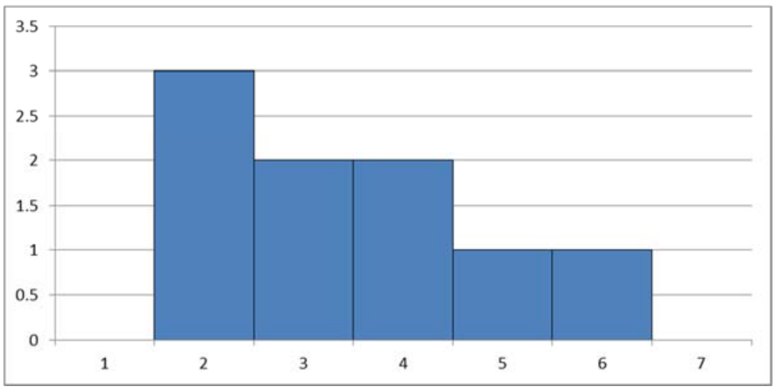

Figure 69: Case 1: Coordinated Alerts, Confirmed, and Considered Spam

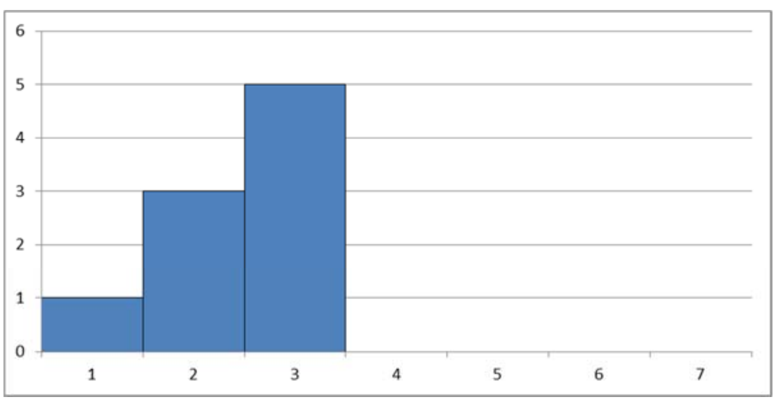

Figure 70: Case 2: Coordinated Alerts, Unconfirmed, and Not Considered Spam

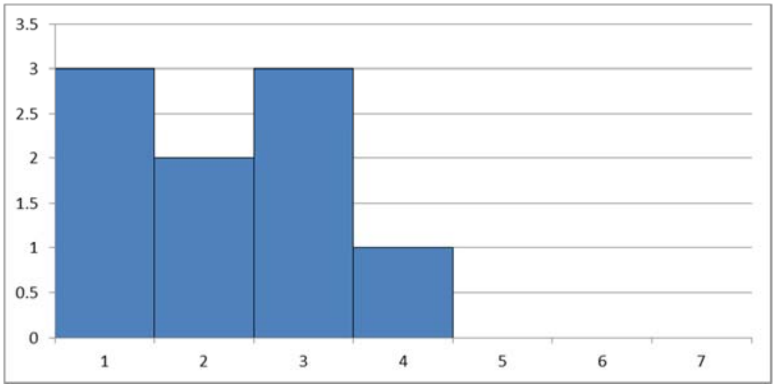

Figure 71: Case 3: Uncoordinated Alerts, Confirmed, and Not Considered Spam

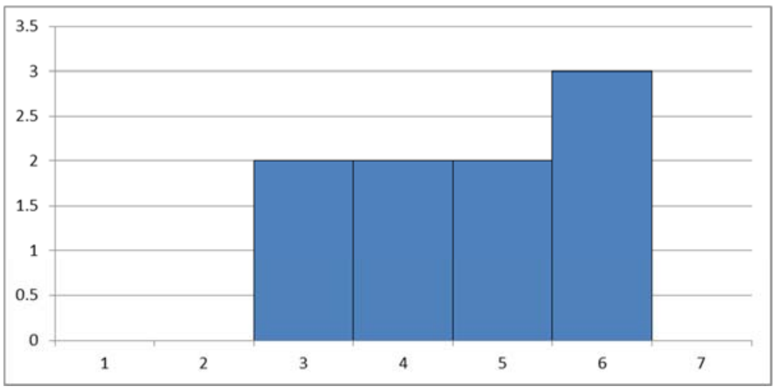

Figure 72: Case 4: Uncoordinated Alerts, Unconfirmed, and Considered Spam

Scenario 6

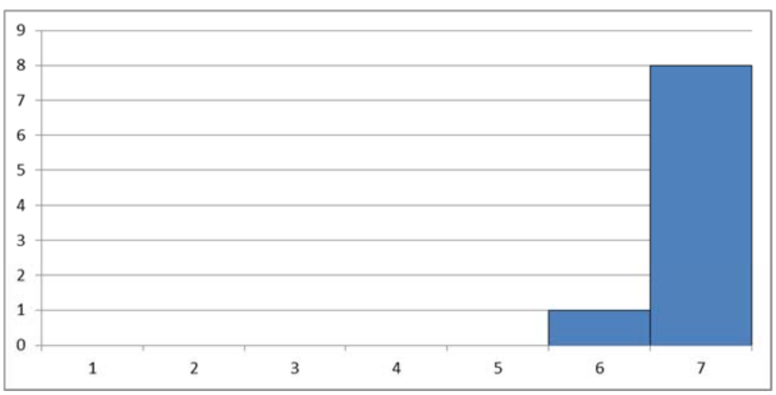

Figure 73: Case 1: Coordinated Alerts, Clear Message, in Primary Language, and "Follow-Us" Mechanisms Present

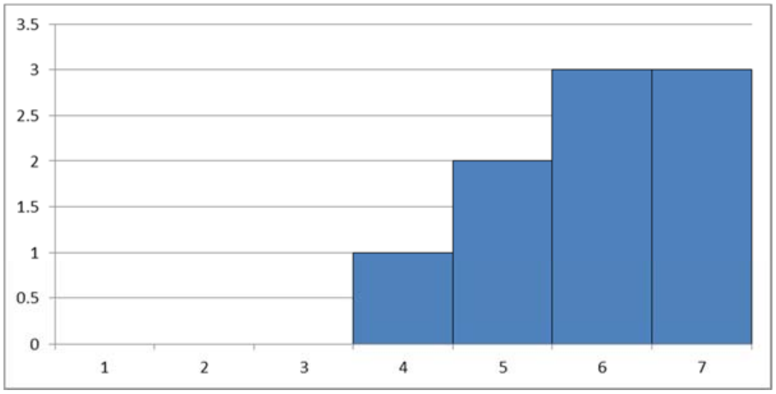

Figure 74: Case 2: Coordinated Alerts, Clear Message, Not in Primary Language, and "Follow-Us" Mechanisms Absent

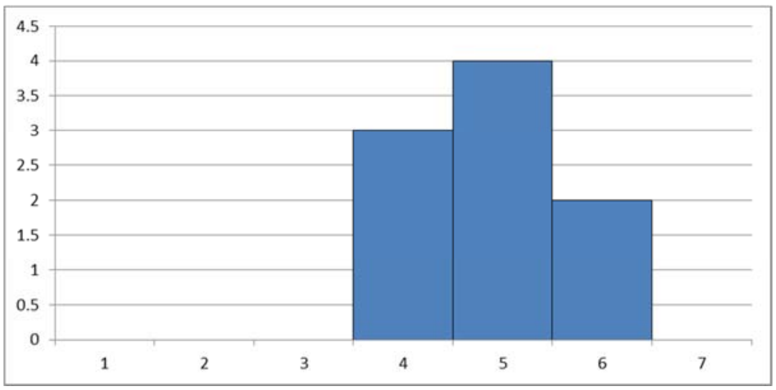

Figure 75: Case 3: Coordinated Alerts, Unclear Message, in Primary Language, and "Follow-Us" Mechanisms Absent

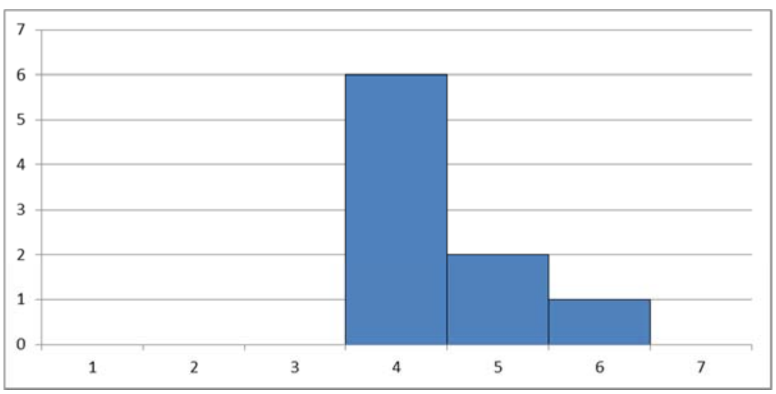

Figure 76: Case 4: Coordinated Alerts, Unclear Message, Not in Primary Language, and "Follow-Us" Mechanisms Present

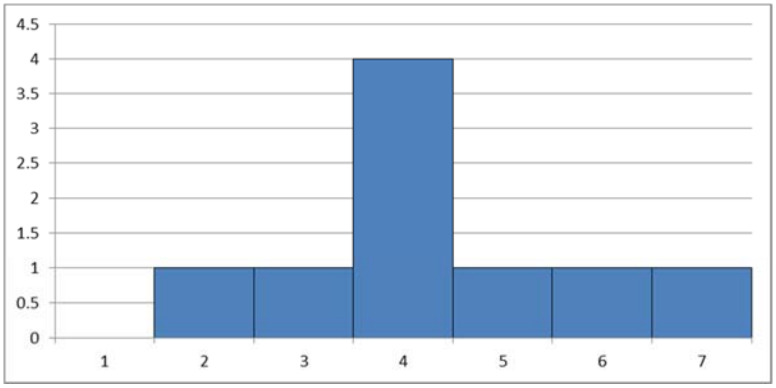

Figure 77: Case 5: Uncoordinated Alerts, Clear Message, in Primary Language, and "Follow-Us" Mechanisms Absent

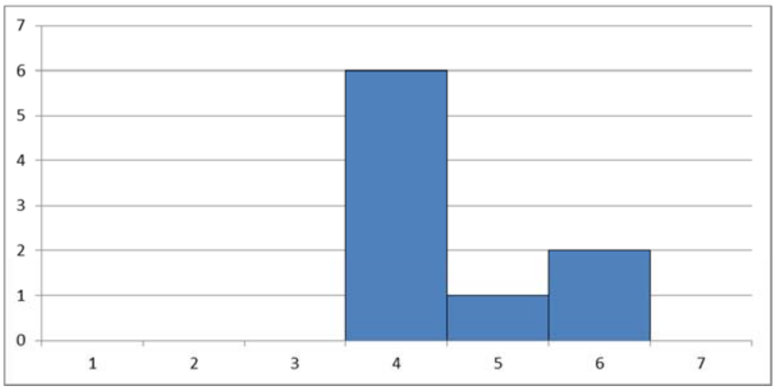

Figure 78: Case 6: Uncoordinated Alerts, Clear Message, in Primary Language, and "Follow-Us" Mechanisms Absent

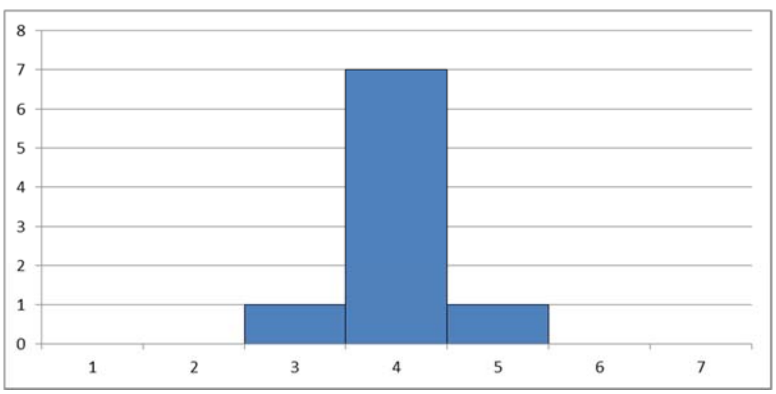

Figure 79: Case 7: Uncoordinated Alerts, Clear Message, in Primary Language, and "Follow-Us" Mechanisms Absent

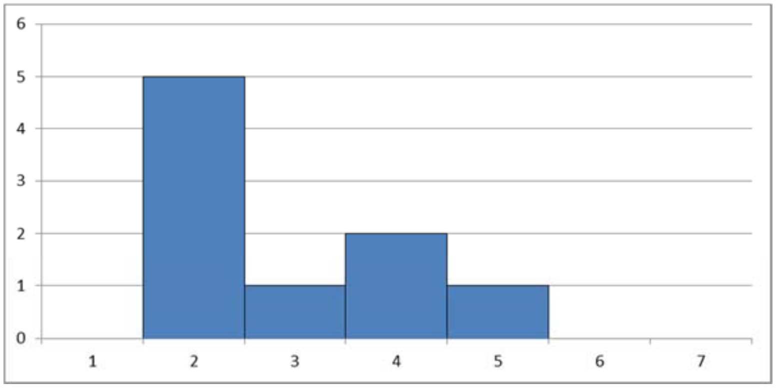

Figure 80: Case 8: Uncoordinated Alerts, Unclear Message, Not in Primary Language, and "Follow-Us" Mechanisms Absent

Scenario 7

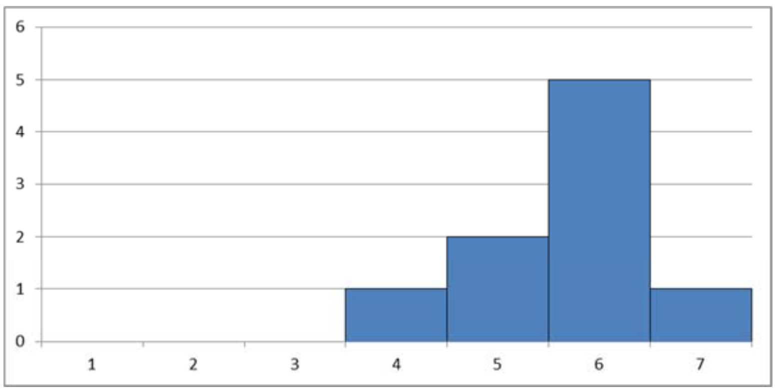

Figure 81: Case 1: Includes "What" and "Why," Relevant, Clear Message, and Not Confirmed via Social Media

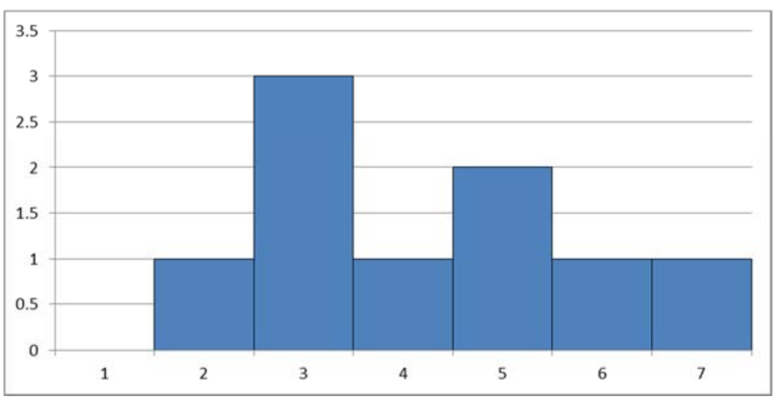

Figure 82: Case 2: Includes "What" and "Why," Irrelevant, Unclear Message, and Confirmed via Social Media

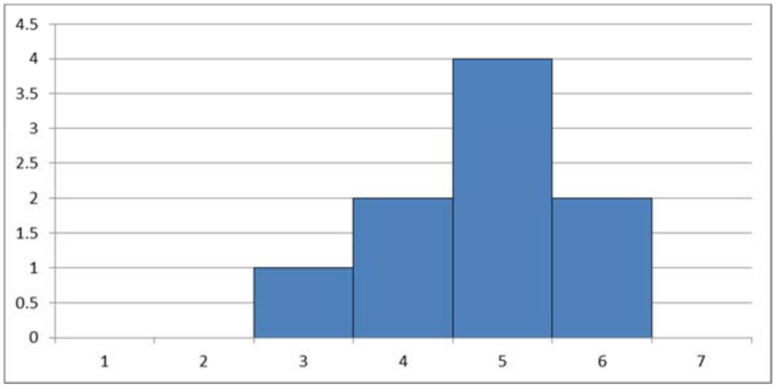

Figure 83: Case 3: Includes "What," Omits "Why," Relevant, Unclear Message, and Confirmed via Social Media

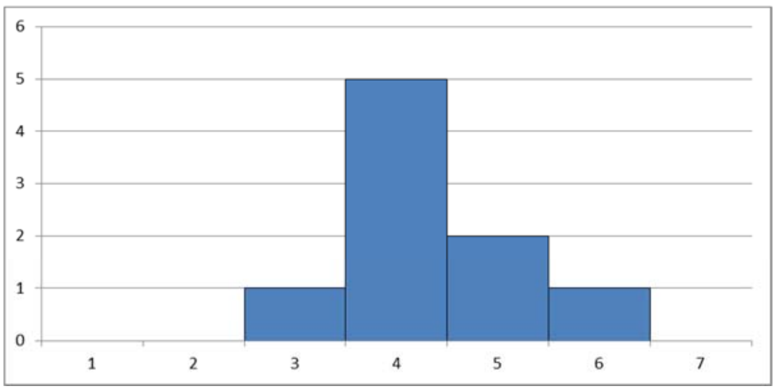

Figure 84: Case 4: Includes "What," Omits "Why," Irrelevant, Clear Message, and Not Confirmed via Social Media

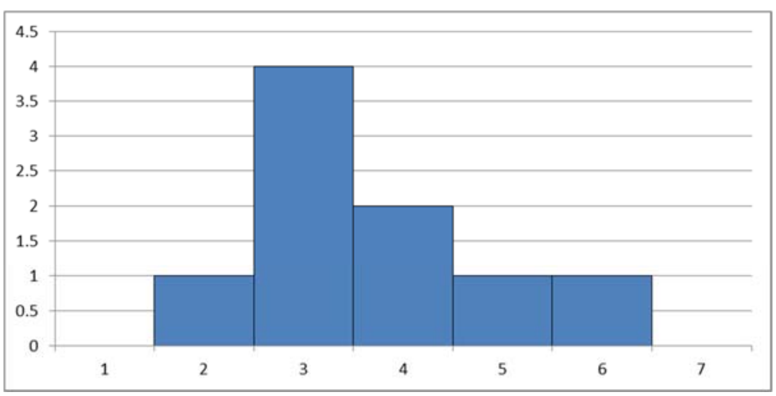

Figure 85: Case 5: Omits "What," Includes "Why," Relevant, Unclear Message, and Not Confirmed via Social Media

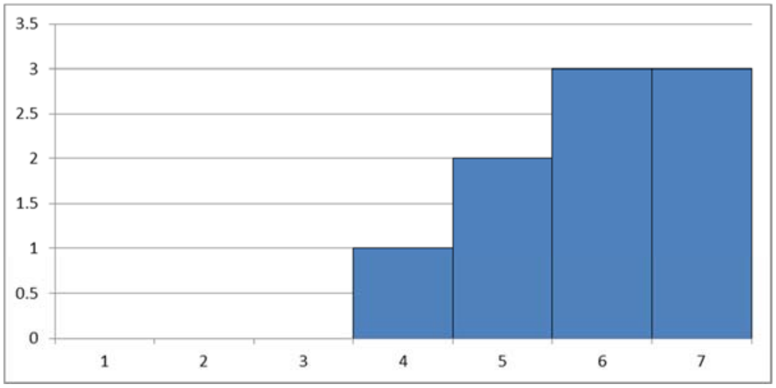

Figure 86: Case 6: Omits "What," Includes "Why," Irrelevant, Clear Message, and Confirmed via Social Media

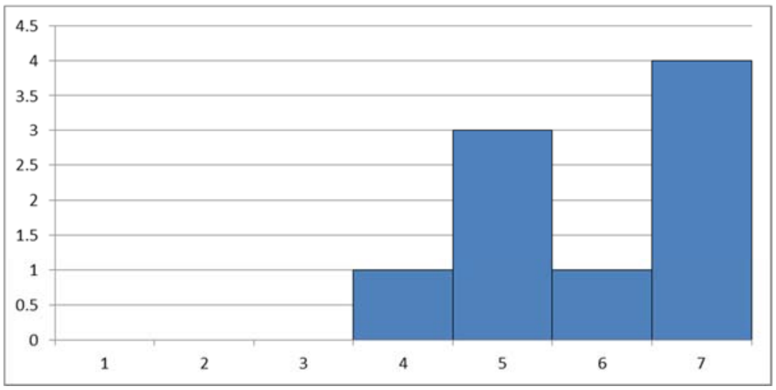

Figure 87: Case 7: Omits "What" and "Why," Relevant, Clear Message, and Confirmed via Social Media

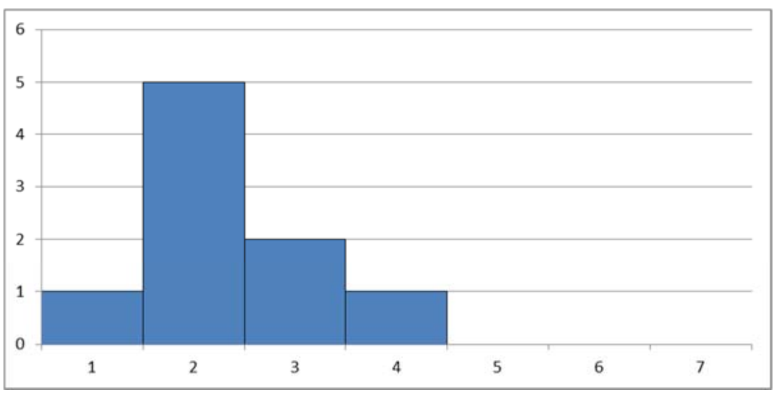

Figure 88: Case 8: Omits "What" and "Why," Irrelevant, Unclear Message, and Not Confirmed via Social Media

Scenario 8

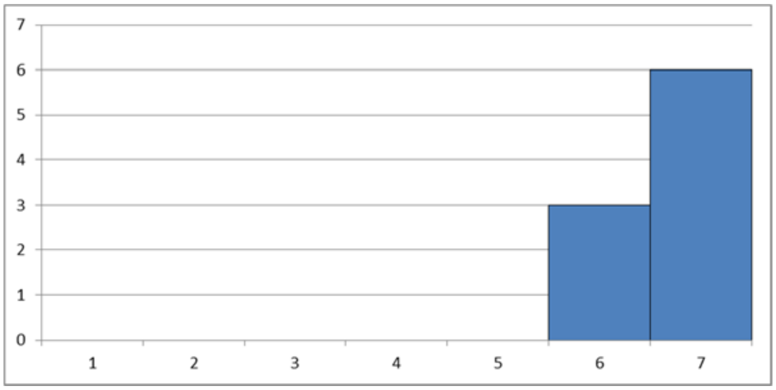

Figure 89: Case 1: Confirmed, History of Relevance, Coordinated, and Public Outreach

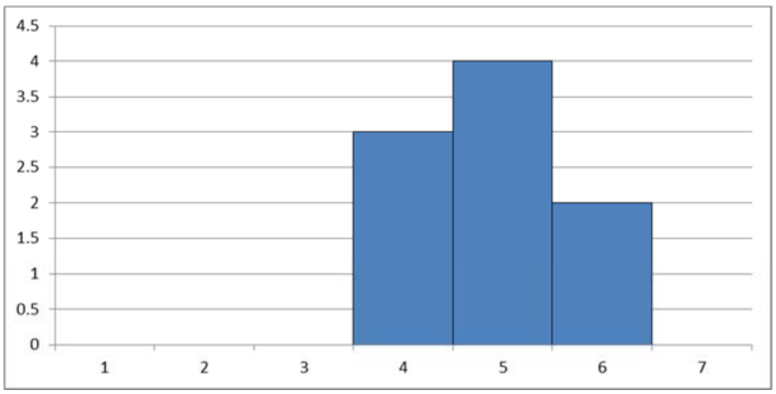

Figure 90: Case 2: Confirmed, History of Relevance, Uncoordinated, and No Public Outreach

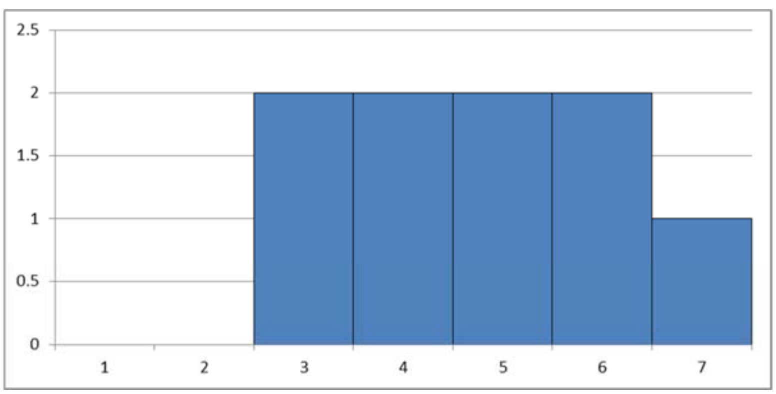

Figure 91: Case 3: Confirmed, History of Irrelevance, Coordinated, and No Public Outreach

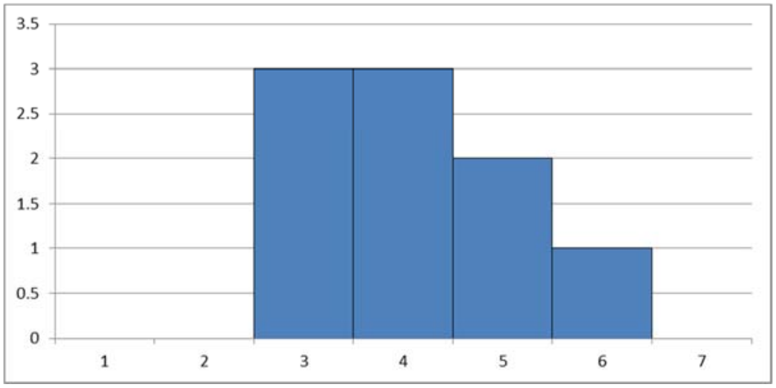

Figure 92: Case 4: Confirmed, History of Irrelevance, Uncoordinated, and Public Outreach

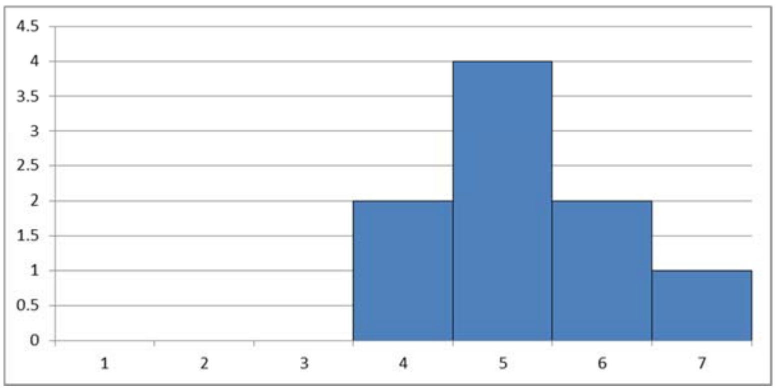

Figure 93: Case 5: Unconfirmed, History of Relevance, Coordinated, and No Public Outreach

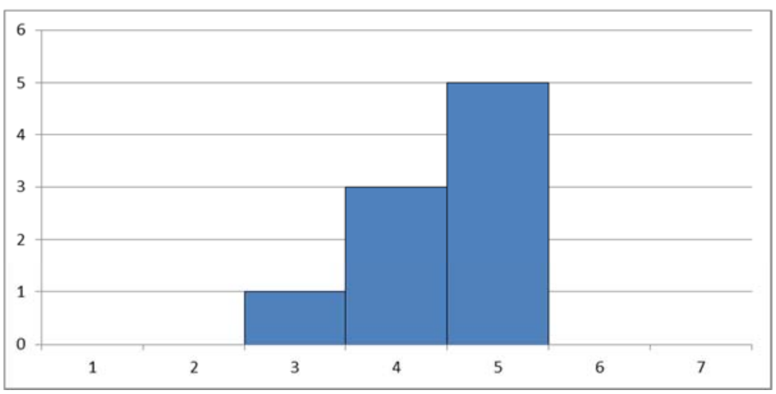

Figure 94: Case 6: Unconfirmed, History of Relevance, Uncoordinated, and Public Outreach

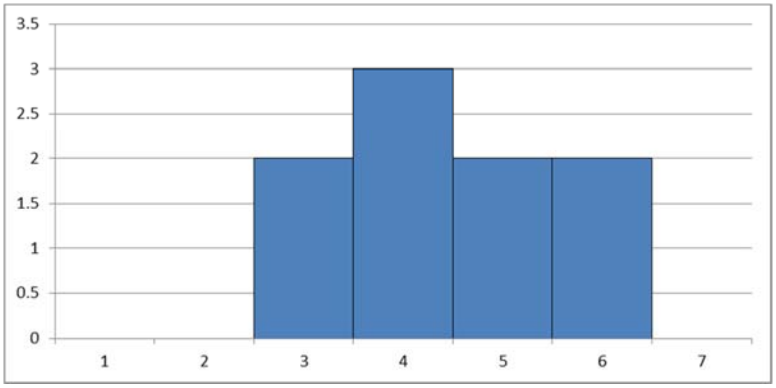

Figure 95: Case 7: Unconfirmed, History of Irrelevance, Coordinated, and Public Outreach

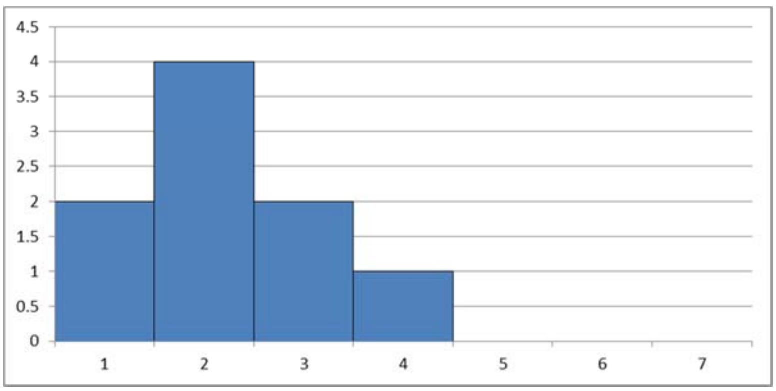

Figure 96: Case 8: Unconfirmed, History of Irrelevance, Uncoordinated, and No Public Outreach

Appendix X Public Trust Model Validation Statistical Analysis

Table 62: Validation of Public BBN Model Against Results of Public Validation Scenario Interviews

Validation	BBN	Factor
0.875	0.73	Relevance
0.875	0.56	Relevance
0.975	0.73	Relevance
0.5	0.56	Relevance
0.125	0.54	Acting
0.875	0.59	Acting
0.875	0.6	Acting
0.025	0.53	Acting
0.025	0.52	Acting
0.975	0.6	Acting
0.975	0.6	Acting
0.025	0.51	Acting
0.125	0.39	ViewSpam
0.7	0.42	ViewSpam
0.5	0.34	ViewSpam
0.3	0.35	ViewSpam
0.5	0.4	ViewSpam
0.3	0.41	ViewSpam
0.125	0.34	ViewSpam
0.5	0.35	ViewSpam
0.5	0.36	ViewSpam
0.3	0.32	ViewSpam
0.125	0.45	ViewSpam
0.975	0.57	ViewSpam
0.3	0.5	OptOut
0.3	0.6	OptOut
0.125	0.5	OptOut
0.7	0.5	OptOut
0.975	0.58	Understand
0.875	0.53	Understand

Validation	BBN	Factor
0.7	0.55	Understand
0.5	0.53	Understand
0.5	0.61	Understand
0.5	0.59	Understand
0.5	0.61	Understand
0.125	0.57	Understand
0.875	0.56	Believe
0.5	0.54	Believe
0.7	0.54	Believe
0.5	0.56	Believe
0.3	0.54	Believe
0.875	0.56	Believe
0.875	0.56	Believe
0.125	0.54	Believe
0.975	0.57	Believe
0.7	0.55	Believe
0.7	0.54	Believe
0.5	0.55	Believe
0.7	0.56	Believe
0.7	0.57	Believe
0.5	0.55	Believe
0.125	0.53	Believe
0.875	0.55	Believe
0.7	0.56	Believe
0.7	0.55	Believe
0.875	0.56	Believe
0.7	0.54	Believe
0.875	0.55	Believe
0.875	0.54	Believe
0.5	0.55	Believe

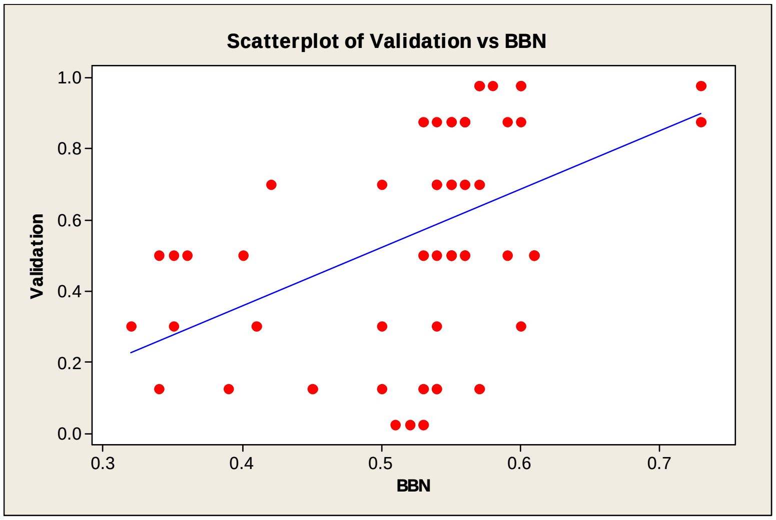

Figure 97: Analysis of All Predictions Across All Outcome Nodes in Table 62

Regression Analysis: Validation vs. BBN

The regression equation is Validation = –0.295 + 1.63 BBN.

Table 63: Regression Coefficient Results for Validation vs. BBN

Predictor	Coef	*SE* Coef	*t*	*p*
Constant	–0.2955	0.2195	–1.35	0.184
BBN	1.6315	0.4109	3.97	0.000

S = 0.267195, R-Sq = 21.4%, R-Sq(adj) = 20.0%

Table 64: Analysis of Variance for Validation vs. BBN

Source	*df*	*SS*	*MS*	*F*	*p*
Regression	1	1.1256	1.1256	15.77	0.000
Residual error	58	4.1408	0.0714		
Total	59	5.2664			

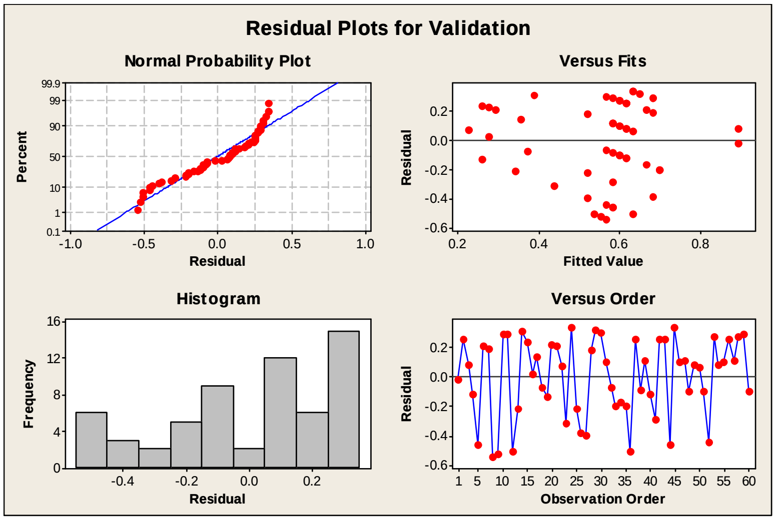

Figure 98: Residual Plots for Regression of Overall Validation as Function of BBN Predictions

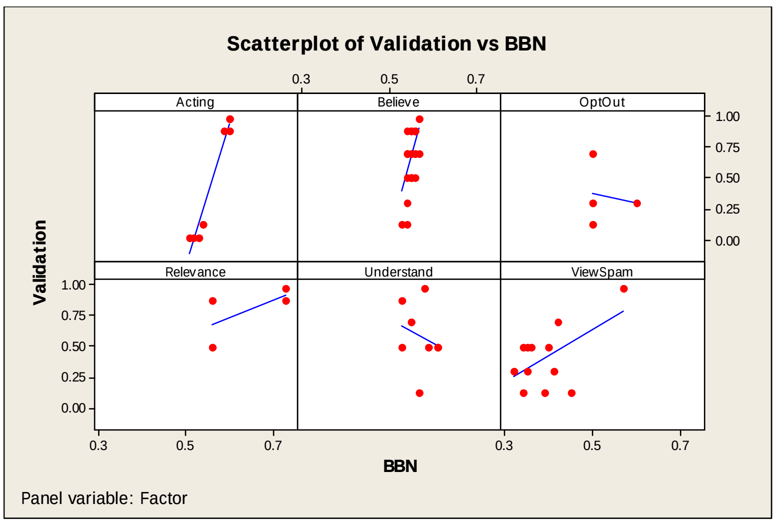

Figure 99: Scatterplots of Six Factors Comparing BBN Predictions to Validation Values

The above attempt to discover significance with all output node types proved unsuccessful. Hence, we performed an analysis by selected factors.

Act: Regression Analysis

The regression equation is Acting-V = –6.04 + 11.6 Acting-B.

Table 65: Regression Coefficient Results for Acting vs. BBN

Predictor	Coef	*SE* Coef	*t*	*p*
Constant	–6.0362	0.4914	–12.28	0.000
BBN	11.6234	0.8737	13.30	0.000

S = 0.0919945, R-Sq = 96.7%, R-Sq(adj) = 96.2%

Table 66: Analysis of Variance for Acting-V vs. Acting-B

Source	***df***	***SS***	***MS***	***F***	***p***
Regression	1	1.4980	1.4980	177.00	0.000
Residual error	6	0.0508	0.0085		
Total	7	1.5487			

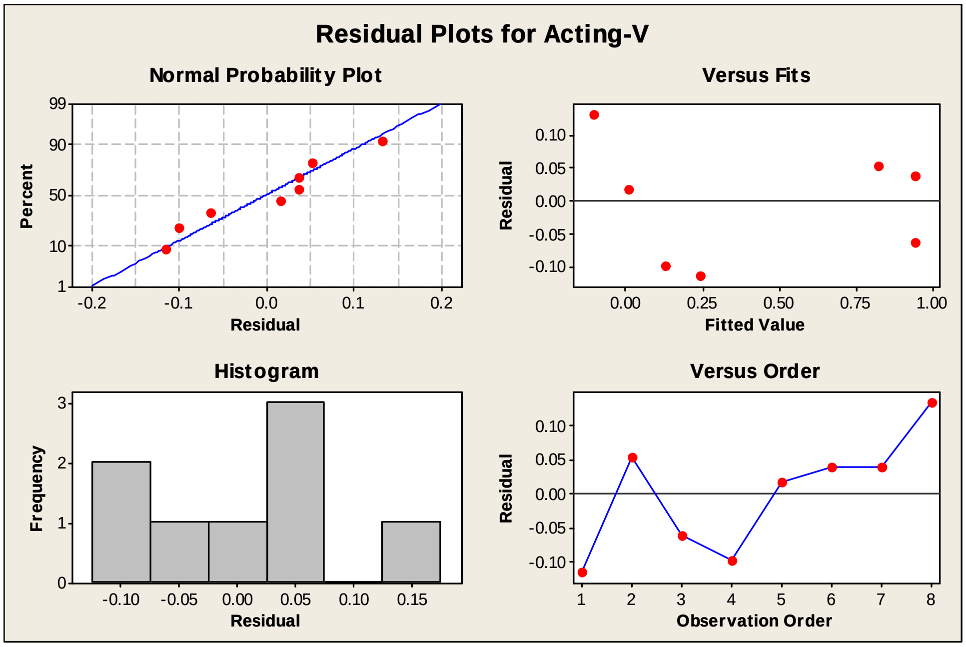

Figure 100: Residual Plots for Regression of Acting Validation as a Function of the BBN

Believe: Regression Analysis

The regression equation is Believe-V = –6.35 + 12.7 Believe-B.

Table 67: Regression Coefficient Results for Believe vs. BBN

Predictor	**Coef**	***SE* Coef**	***t***	***p***
Constant	–6.354	2.127	–2.99	0.007
BBN	12.726	3.860	3.30	0.003

S = 0.196209, R-Sq = 33.1%, R-Sq(adj) = 30.0%

Table 68: Analysis of Variance for Believe-V vs. Believe-B

Source	***df***	***SS***	***MS***	***F***	***p***
Regression	1	0.41836	0.41836	10.87	0.003
Residual error	22	0.84695	0.03850		
Total	23	1.26531			

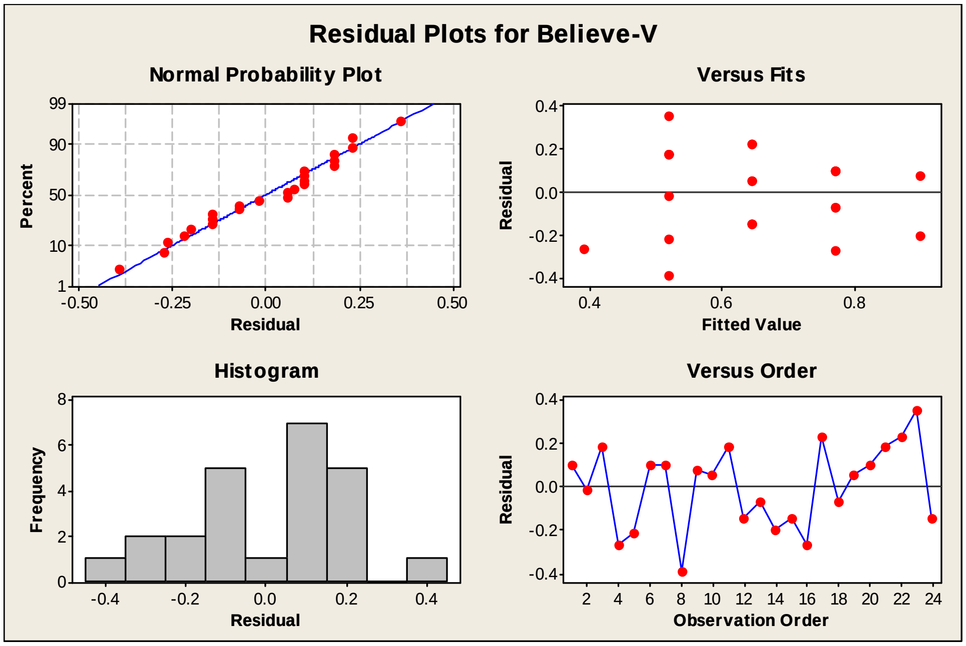

Figure 101: Residual Plots for Regression of Believing Validation as a Function of the BBN

Understand: Regression Analysis

The regression equation is Understand-V = 1.77 – 2.07 Understand-B.

Table 69: Regression Coefficient Results for Understand vs. BBN

Predictor	Coef	*SE* Coef	*t*	*p*
Constant	1.768	1.853	0.95	0.377
BBN	–2.071	3.239	–0.64	0.546

S = 0.276484, R-Sq = 6.4%, R-Sq(adj) = 0.0%

Table 70: Analysis of Variance for Understand-V vs. Understand-B

Source	*df*	*SS*	*MS*	*F*	*p*
Regression	1	0.03126	0.03126	0.41	0.546
Residual error	6	0.45866	0.07644		
Total	7	0.48992			

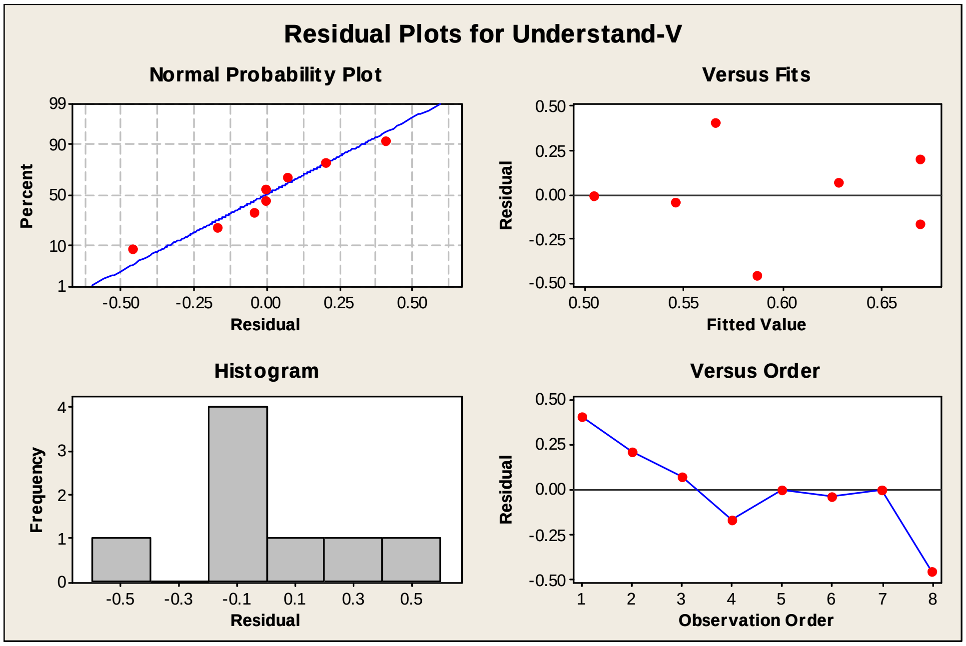

Figure 102: Residual Plots for Regression of Understand Validation as a Function of the BBN

View as Spam: Regression Analysis

The regression equation is ViewSpam-V = –0.407 + 2.09 ViewSpam-B.

Table 71: Regression Coefficient Results for ViewSpam vs. BBN

Predictor	Coef	*SE* Coef	*t*	*p*
Constant	–0.4072	0.3881	–1.05	0.319
BBN	2.0928	0.9773	2.14	0.058

S = 0.221506, R-Sq = 31.4%, R-Sq(adj) = 24.6%

Table 72: Analysis of Variance for ViewSpam-V vs. ViewSpam-B

Source	*df*	*SS*	*MS*	*F*	*p*
Regression	1	0.22498	0.22498	4.59	0.058
Residual error	10	0.49065	0.04906		
Total	11	0.71562			

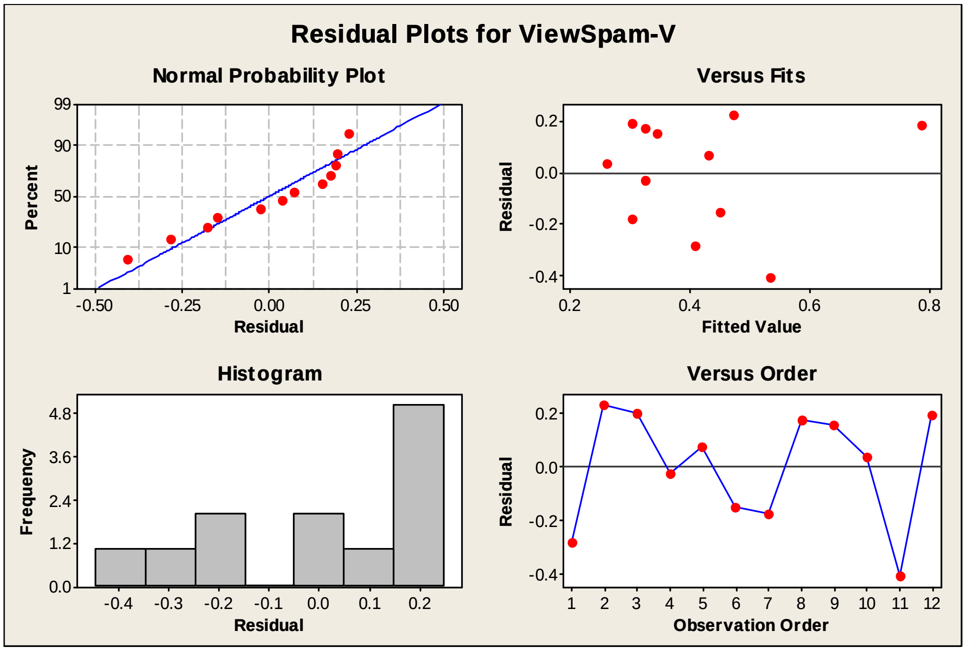

Figure 103: Residual Plots for Regression of ViewSpam Validation as a Function of the BBN

Opt Out: Regression Analysis

The regression equation is OptOut-V = 0.75 – 0.75 OptOut-B.

Table 73: Regression Coefficient Results for OptOut vs. BBN

Predictor	Coef	*SE* Coef	*t*	*p*
Constant	0.750	1.793	0.42	0.716
BBN	–0.750	3.403	–0.22	0.846

S = 0.294746, R-Sq = 2.4%, R-Sq(adj) = 0.0%

Table 74: Analysis of Variance for OptOut-V vs. OptOut-B

Source	*df*	*SS*	*MS*	*F*	*p*
Regression	1	0.00422	0.00422	0.05	0.846
Residual error	2	0.17375	0.08688		
Total	3	0.17797			

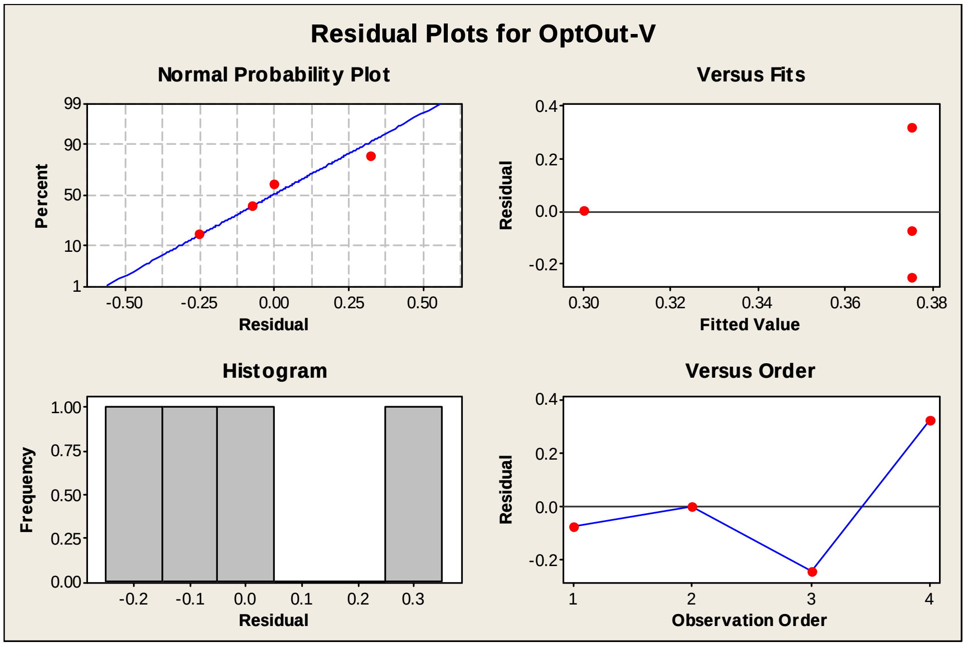

Figure 104: Residual Plots for Regression of OptOut Validation as a Function of the BBN

Relevance: Regression Analysis

The regression equation is Relevance-V = –0.095 + 1.40 Relevance-B.

Table 75: Regression Coefficient Results for Relevance vs. BBN

Predictor	Coef	*SE* Coef	*t*	*p*
Constant	–0.0949	0.7426	–0.13	0.910
BBN	1.397	1.141	1.22	0.346

S = 0.194052, R-Sq = 42.8%, R-Sq(adj) = 14.2%

Table 76: Analysis of Variance for Relevance-V vs. Relevance-B

Source	*df*	*SS*	*MS*	*F*	*p*
Regression	1	0.05641	0.05641	1.50	0.346
Residual error	2	0.07531	0.03766		
Total	3	0.13172			

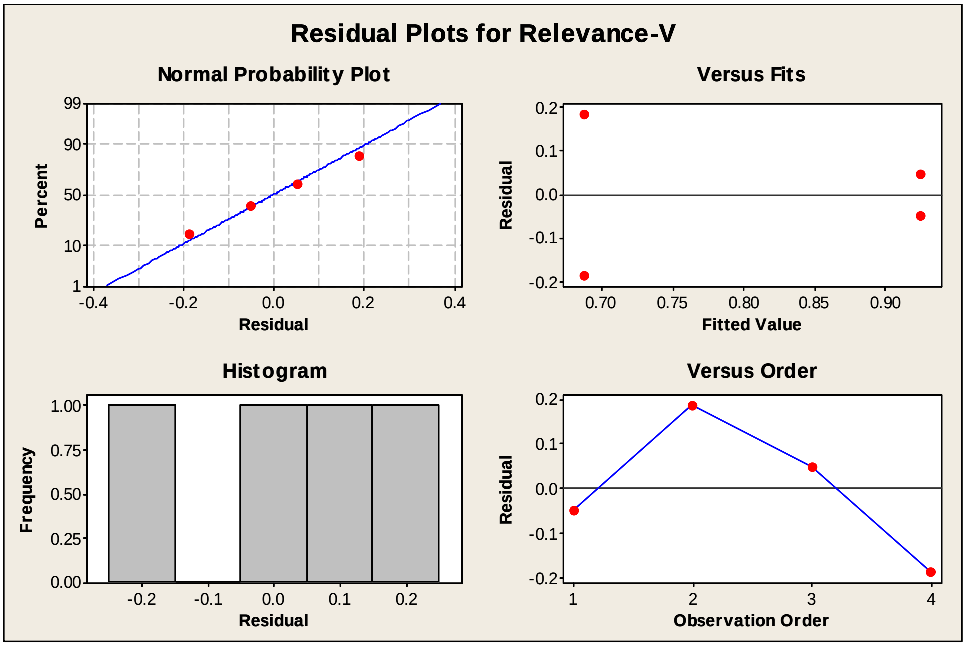

Figure 105: Residual Plots for Regression of Relevance Validation as a Function of the BBN

Understand Plus Believe Plus Act: Regression Analysis

The regression equation is Validation = –2.52 + 5.61 BBN.

Table 77: Regression Coefficient Results for Understand, Believe, and Act vs. BBN

Predictor	Coef	*SE* Coef	*t*	*p*
Constant	–2.5191	0.9729	–2.59	0.014
BBN	5.614	1.745	3.2	0.003

S = 0.268294, R-Sq = 21.4%, R-Sq(adj) = 19.3%

Table 78: Analysis of Variance for Understand, Believe, and Act vs. BBN

Source	*df*	*SS*	*MS*	*F*	*p*
Regression	1	0.74517	0.74517	10.35	0.003
Residual error	38	2.73531	0.07198		
Total	39	3.48048			

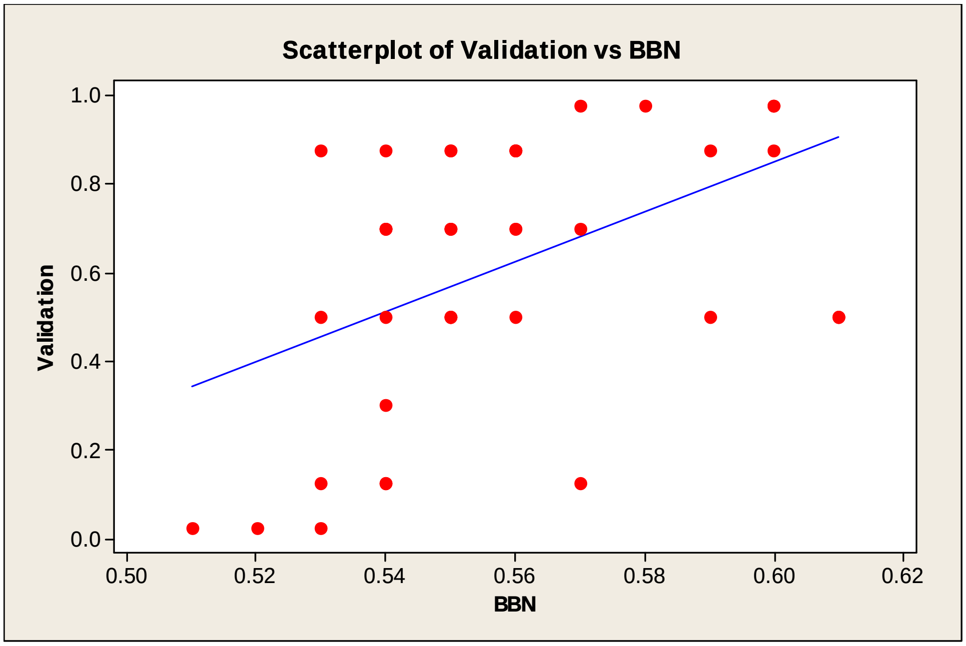

Figure 106: *Scatterplot of BBN Predictions vs. Validation for Understand, Believe, and Act Only*

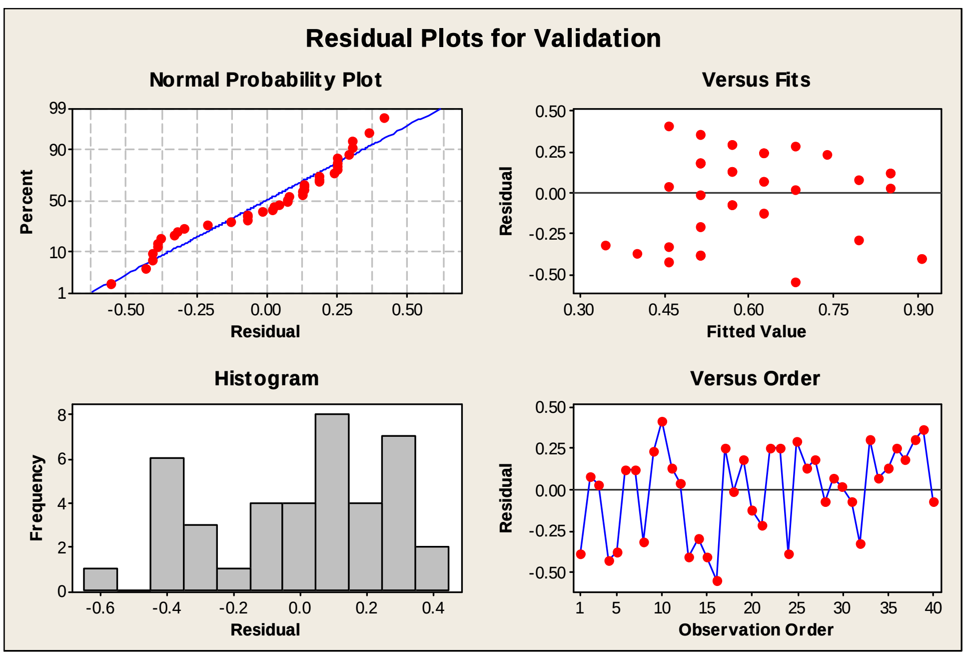

Figure 107: *Residual Plots for Regression of Understand, Believe, and Act Only Validation as a Function of the BBN*

Appendix Y Alert Originator Trust Model Validation Scenarios and Responses

Response Key

1 = Definitely not (<5%)
2 = Very probably not (5–20%)
3 = Probably not (20–40%)
4 = Maybe (40–60%)
5 = Probably (60–80%)
6 = Very probably (80–95%)
7 = Definitely (>95%)

Table 79: Alert Originator Trust Model Validation Data

Scenario			Factors				Responses								
Context	**Case**	**Description**	**Training**	**Cybersecurity**	**Governance**		**A1**	**B1**	**B2**	**C1**	**C2**	**D1**	**E1**	**F1**	**F2**
Your agency chose to deploy WEA to issue public alerts 16 months ago. The system is fully functional, and through training and practice you are fully capable of issuing alerts. Thunderstorms have been occurring across your city for the past 24 hours. NWS has responsibility for generating alerts for weather-related events and has issued an alert for flash flooding of several low-lying areas within the city. You receive reliable and confirmed information that a dam break on the Little Bear reservoir is imminent. This will result in major flooding downstream. For each case below, please indicate how likely you are to use WEA to issue a public alert under the stated circumstances?	Case 1: sufficient training, sufficient cybersecurity, insufficient governance	You have been fully trained on the use of WEA, and you understand both the principles behind WEA and the operation of the alerting software used in your agency. You have successfully practiced issuing alerts with your alerting software. You have templates for alerts that can be applied to this event. Over the past 12 months, no cybersecurity breaches of the WEA service (e.g., access by unauthorized personnel, issuance of false alerts) have occurred in your agency, and none have been reported by other agencies. You have an agreement with the local NWS office regarding the division of responsibilities for alerting. This agreement clearly defines that NWS will issue alerts for all weather-related emergencies, and your agency will issue alerts for all other imminent threats. However, since the imminent dam break is the result of the ongoing thunderstorms, you are unsure of your responsibility for issuing an alert for this threat.	1	1	0		6	6	7	7	7	6	6	7	7

Scenario			Factors				Responses								
Context	Case	Description	Training	Cybersecurity	Governance		A1	B1	B2	C1	C2	D1	E1	F1	F2
(see previous page)	Case 2: sufficient training, insufficient cybersecurity, sufficient governance	You have been fully trained on the use of WEA, and you understand both the principles behind WEA and the operation of the alerting software used in your agency. You have successfully practiced issuing alerts with your alerting software. You have templates for alerts that can be applied to this event. Over the past 12 months, several cybersecurity breaches of the WEA service (e.g., access by unauthorized personnel, issuance of false alerts) have occurred in your agency, and others have been reported by other agencies. You have an agreement with the local NWS office regarding the division of responsibilities for alerting. This agreement clearly defines that NWS will issue alerts for all weather -related emergencies, and your agency will issue alerts for all other imminent threats. Since the imminent dam break is not a weather event, you are sure of your responsibility for issuing an alert for this threat.	1	0	1		6	7	7	7	7	6	3	7	7

Scenario			Factors				Responses								
Context	Case	Description	Training	Cybersecurity	Governance		A1	B1	B2	C1	C2	D1	E1	F1	F2
(see previous page)	Case 3: insufficient training, sufficient cybersecurity, sufficient governance	You have not been fully trained on the use of WEA, and you have only a basic understanding of both the principles behind WEA and the operation of the alerting software used in your agency. You have not had opportunities to practice issuing alerts with your alerting software. You do not have templates for alerts that can be applied to this event. Over the past 12 months, no cybersecurity breaches of the WEA service (e.g., access by unauthorized personnel, issuance of false alerts) have occurred in your agency, and none have been reported by other agencies. You have an agreement with the local NWS office regarding the division of responsibilities for alerting. This agreement clearly defines that NWS will issue alerts for all weather-related emergencies, and your agency will issue alerts for all other imminent threats. Since the imminent dam break is not a weather event, you are sure of your responsibility for issuing an alert for this threat.	0	1	1		3	6	7	6	6	5	5	3	4

Scenario			Factors				Responses								
Context	Case	Description	Training	Cybersecurity	Governance		A1	B1	B2	C1	C2	D1	E1	F1	F2
(see previous page)	Case 4: insufficient training, insufficient cybersecurity, insufficient governance	You have not been fully trained on the use of WEA, and you have only a basic understanding of both the principles behind WEA and the operation of the alerting software used in your agency. You have not had opportunities to practice issuing alerts with your alerting software. You do not have templates for alerts that can be applied to this event. Over the past 12 months, several cybersecurity breaches of the WEA service (e.g., access by unauthorized personnel, issuance of false alerts) have occurred in your agency, and others have been reported by other agencies. You have an agreement with the local NWS office regarding the division of responsibilities for alerting. This agreement clearly defines that NWS will issue alerts for all weather-related emergencies, and your agency will issue alerts for all other imminent threats. However, since the imminent dam break is the result of the ongoing thunderstorms, you are unsure of your responsibility for issuing an alert for this threat.	0	0	0		1	4	6	6	6	2	3	1	3

Scenario			Factors				Responses								
Context	**Case**	**Description**	**Public Feedback**	**Public Outreach**	**Alert Frequency**		**A1**	**B1**	**B2**	**C1**	**C2**	**D1**	**E1**	**F1**	**F2**
Your agency chose to deploy WEA to issue public alerts 6 months ago. The system is fully functional, and through training and practice you are fully capable of issuing alerts. For each case below, please indicate how likely you are to use WEA to issue a public alert for an imminent threat under the stated circumstances?	Case 1: favorable feedback, public outreach, many prior alerts	The public has responded to prior alerts with calls to 9-1-1 operators, and calls and emails to the EMA, the mayor, and the city council. 47% of the callers expressed questions about the WEA service (e.g., What is this service? What should I do? Why am I getting these alerts? How does WEA know where I am?), 42% expressed appreciation for the alerts received, and 11% objected to receiving the alerts. Prior to deploying WEA, your agency performed public outreach via TV, radio, and newspapers to inform the public about the upcoming alerting service. Within your jurisdiction over the past 6 months, the NWS has used WEA to issue 48 weather-related (e.g., tornadoes, thunderstorms) alerts. No AMBER alerts have been issued. Your agency has issued 18 alerts for various imminent threats (e.g., police actions, chemical spills, structure fires).	1	1	0		5	7	7	7	7	5	6	7	7

Scenario			Factors				Responses								
Context	**Case**	**Description**	**Public Feedback**	**Public Outreach**	**Alert Frequency**		**A1**	**B1**	**B2**	**C1**	**C2**	**D1**	**E1**	**F1**	**F2**
(see previous page)	Case 2: favorable feedback, no public outreach, few prior alerts	The public has responded to prior alerts with calls to 9-1-1 operators, and calls and emails to the EMA, the mayor, and the city council. 47% of the callers expressed questions about the WEA service (e.g., What is this service? What should I do? Why am I getting these alerts? How does WEA know where I am?), 42% expressed appreciation for the alerts received, and 11% objected to receiving the alerts. Your agency has not performed public outreach via TV, radio, and newspapers to inform the public about the WEA service. Within your jurisdiction over the past 6 months, the NWS has used WEA to issue 8 weather-related (e.g., tornadoes, snowstorms) alerts. No AMBER alerts have been issued. Your agency has issued 3 alerts for imminent threats: one for a police action (armed standoff), one for a chemical spill, and one for a fire requiring a 4-square-block evacuation.	1	0	1		6	7	7	7	7	5	6	7	7

Scenario			Factors				Responses								
Context	Case	Description	Public Feedback	Public Outreach	Alert Frequency		A1	B1	B2	C1	C2	D1	E1	F1	F2
(see previous page)	Case 3: unfavorable feedback, public outreach, few prior alerts	The public has responded to prior alerts with calls to 9-1-1 operators, and calls and emails to the EMA, the mayor, and the city council. 47% of the callers expressed questions about the WEA service (e.g., What is this service? What should I do? Why am I getting these alerts? How does WEA know where I am?), 11% expressed appreciation for the alerts received, and 42% objected to receiving the alerts. Prior to deploying WEA, your agency performed public outreach via TV, radio, and newspapers to inform the public about the WEA service. Within your jurisdiction over the past 6 months, the NWS has used WEA to issue 8 weather-related (e.g., tornadoes, snowstorms) alerts. No AMBER alerts have been issued. Your agency has issued 3 alerts for imminent threats: one for a police action (armed standoff), one for a chemical spill, and one for a fire requiring a 4-square-block evacuation.	0	1	1		5.5	7	7	5	5	2	5	7	7

Scenario			Factors				Responses								
Context	Case	Description	Public Feedback	Public Outreach	Alert Frequency		A1	B1	B2	C1	C2	D1	E1	F1	F2
(see previous page)	Case 4: unfavora-ble feedback, no public outreach, many prior alerts	The public has responded to prior alerts with calls to 9-1-1 operators, and calls and emails to the EMA, the mayor, and the city council. 47% of the callers expressed ques-tions about the WEA service (e.g., What is this service? What should I do? Why am I getting these alerts? How does WEA know where I am?), 11% expressed apprecia-tion for the alerts received, and 42% objected to receiving the alerts. Your agency has not performed public outreach via TV, radio, and newspapers to inform the public about the WEA service. Within your jurisdiction over the past 6 months, the NWS has used WEA to issue 48 weather-related (e.g., torna-does, thunderstorms) alerts. No AMBER alerts have been issued. Your agency has issued 18 alerts for various imminent threats (e.g., police actions, chemical spills, structure fires).	0	0	0		5	5	7	5	5	2	4	7	7

Scenario			Factors				Responses								
Context	**Case**	**Description**	**Availability**	**Accessibility**	**Reliability**	**Ease of use**	**A1**	**B1**	**B2**	**C1**	**C2**	**D1**	**E1**	**F1**	**F2**
Your agency chose to deploy WEA to issue public alerts 6 months ago. The system is fully functional, and through training and practice you are fully capable of issuing alerts. For each case below, please indicate how likely you are to use WEA to issue a public alert for an imminent threat under the stated circumstances.	Case 1: high availability, high accessibility, high reliability, easy to use	Over the past 12 months, the WEA service has been down for maintenance approximately 1 hour per year. WEA alerts can be generated and issued from your office or from your smartphone using a secure app that interfaces to your alert generation software. Your alerting software and the WEA service successfully transmits 99.9% of alerts that are correctly configured and entered. The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately 5 minutes of effort.	1	1	1	1	7	7	7	7	7	6	7	7	7
	Case 2: high availability, high accessibility, low reliability, difficult to use	Over the past 12 months, the WEA service has been down for maintenance approximately 1 hour per year. WEA alerts can be generated and issued from your office or from your smartphone using a secure app that interfaces to your alert generation software. Your alerting software and the WEA service successfully transmit 90% of alerts that are correctly configured and entered. The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately 40 minutes of effort.	1	1	0	0	4	5	4	4	4	2	2	3	4

Scenario			Factors				Responses								
Context	Case	Description	Availability	Accessibility	Reliability	Ease of use	A1	B1	B2	C1	C2	D1	E1	F1	F2
(see previous page)	Case 3: high availability, low accessibility, high reliability, difficult to use	Over the past 12 months, the WEA service has been down for maintenance approximately 1 hour per year. WEA alerts can be generated and issued only from a dedicated terminal within your agency's central office. Your alerting software and the WEA service successfully transmit 99.9% of alerts that are correctly configured and entered. The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately 40 minutes of effort.	1	0	1	0	4	5	4	4	1	2	2	4	3
	Case 4: high availability, low accessibility, low reliability, easy to use	Over the past 12 months, the WEA service has been down for maintenance approximately 1 hour per year. WEA alerts can be generated and issued only from a dedicated terminal within your agency's central office. Your alerting software and the WEA service successfully transmit 90% of alerts that are correctly configured and entered. The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately 5 minutes of effort.	1	0	0	1	5	7	6	6	3	6	5	7	7

Scenario			Factors				Responses								
Context	**Case**	**Description**	**Availability**	**Accessibility**	**Reliability**	**Ease of use**	**A1**	**B1**	**B2**	**C1**	**C2**	**D1**	**E1**	**F1**	**F2**
(see previous page)	Case 5: low availability, high accessibility, high reliability, difficult to use	Over the past 12 months, the WEA service has been down for maintenance approximately 1 hour per week. WEA alerts can be generated and issued from your office or from your smartphone using a secure app that interfaces to your alert generation software. Your alerting software and the WEA service successfully transmit 99.9% of alerts that are correctly configured and entered. The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately 40 minutes of effort.	0	1	1	0	4	4	4	4	4	2	2	3	3
	Case 6: low availability, high accessibility, low reliability, easy to use	Over the past 12 months, the WEA service has been down for maintenance approximately 1 hour per week. WEA alerts can be generated and issued from your office or from your smartphone using a secure app that interfaces to your alert generation software. Your alerting software and the WEA service successfully transmit 90% of alerts that are correctly configured and entered. The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately 5 minutes of effort.	0	1	0	1	5	6	6	7	7	6	5	7	7

Scenario			Factors				Responses								
Context	Case	Description	Availability	Accessibility	Reliability	Ease of use	A1	B1	B2	C1	C2	D1	E1	F1	F2
(see previous page)	Case 7: low availability, low accessibility, high reliability, easy to use	Over the past 12 months, the WEA service has been down for maintenance approximately 1 hour per week. WEA alerts can be generated and issued only from a dedicated terminal within your agency's central office. Your alerting software and the WEA service successfully transmit 99.9% of alerts that are correctly configured and entered. The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately 5 minutes of effort.	0	0	1	1	5	6	7	7	4	6	5	7	7
	Case 8: low availability, low accessibility, low reliability, difficult to use	Over the past 12 months, the WEA service has been down for maintenance approximately 1 hour per week. WEA alerts can be generated and issued only from a dedicated terminal within your agency's central office. Your alerting software and the WEA service successfully transmit 90% of alerts that are correctly configured and entered. The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately 40 minutes of effort.	0	0	0	0	3	4	4	4	1	2	2	3	3

Scenario			Factors				Responses								
Context	**Case**	**Description**	**Timeliness**	**Understandability**	**Accuracy**		**A1**	**B1**	**B2**	**C1**	**C2**	**D1**	**E1**	**F1**	**F2**
Your agency chose to deploy WEA to issue public alerts 6 months ago. The system is fully functional, and through training and practice you are fully capable of issuing alerts. For each case below, please indicate how likely you are to use WEA to issue a public alert for an imminent threat under the stated circumstances.	Case 1: rapid dissemination, high understandability, low accuracy	Prior messages have been distributed within 2 minutes of your submitting the WEA data input. You can craft any message of your choosing with a maximum size of 270 characters. Prior WEA messages sent to IPAWS-OPEN have been disseminated with significant errors in the message data (errors that affect the understandability or content of the message).	1	1	0		3	6	7	4	4	2	4	4	7
	Case 2: rapid dissemination, low understandability, high accuracy	Prior messages have been distributed within 2 minutes of your submitting the WEA data input. You are able to issue only "standardized" messages developed by the WEA service based on your CAP (Common Alerting Protocol) inputs. In other words, you may not tailor the message. Prior WEA messages sent to IPAWS-OPEN have been disseminated with no errors in the message data.	1	0	1		4	6	7	7	7	5	6	7	7
	Case 3: slow dissemination, high understandability, high accuracy	Prior messages have been distributed within 10 to 30 minutes of your submitting the WEA data input. You can craft any message of your choosing with a maximum size of 270 characters. Prior WEA messages sent to IPAWS-OPEN have been disseminated with no errors in the message data.	0	1	1		4	5	4	5	5	5	4	7	7

Scenario			Factors				Responses								
Context	**Case**	**Description**	**Timeliness**	**Understandability**	**Accuracy**		**A1**	**B1**	**B2**	**C1**	**C2**	**D1**	**E1**	**F1**	**F2**
(see previous page)	Case 4: slow dissemination, low understandability, low accuracy	Prior messages have been distributed within 10 to 30 minutes of your submitting the WEA data input. You are able to issue only "standardized" messages developed by the WEA service based on your CAP (Common Alerting Protocol) inputs. In other words, you may not tailor the message. Prior WEA messages sent to IPAWS-OPEN have been disseminated with significant errors in the message data (errors that affect the understandability or content of the message).	0	0	0		1	4	6	3	3	1	2	4	4

Scenario			Factors				Responses								
Context	**Case**	**Description**	**Urgency**	**Severity**	**Certainty**		**A1**	**B1**	**B2**	**C1**	**C2**	**D1**	**E1**	**F1**	**F2**
Your agency chose to deploy WEA to issue public alerts 6 months ago. The system is fully functional, and through training and practice you are fully capable of issuing alerts. For each case below, please indicate how likely you are to use WEA to issue a public alert for an imminent threat under the stated circumstances.	Case 1: high urgency, high severity, low certainty	For an event that requires public action within 10 minutes. For an event that poses extraordinary threat to life. For a severe and urgent event that is 30% likely to occur.	1	1	0		5	6	7	6	6	6	6	7	7
	Case 2: high urgency, low severity, high certainty	For an event that requires public action within 10 minutes. For an event that poses possible threat to property. For a severe and urgent event that is 90% likely to occur.	1	0	1		3	6	7	5	5	5	5	1	3
	Case 3: low urgency, high severity, high certainty	For an event that requires public action within 2 hours. For an event that poses extraordinary threat to life. For a severe and urgent event that is 90% likely to occur.	0	1	1		7	6	7	7	7	7	5	7	7
	Case 4: low urgency, low severity, low certainty	For an event that requires public action within 2 hours. For an event that poses possible threat to property. For a severe and urgent event that is 30% likely to occur.	0	0	0		1	4	2	3	3	1	2	1	2

Scenario			Factors				Responses								
Context	Case	Description	Geographic Breadth				A1	B1	B2	C1	C2	D1	E1	F1	F2
Your agency chose to deploy WEA to issue public alerts 6 months ago. The system is fully functional, and through training and practice you are fully capable of issuing alerts. Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event ...	small event / large alert	… where <u>30%</u> of the alert recipients are in the hazard zone and <u>70%</u> are outside the zone?	0				1	6	7	3	3	2	4	7	7
	large event / large alert	… where <u>90%</u> of the alert recipients are in the hazard zone and <u>10%</u> are outside the zone?	1				7	7	7	7	7	6	7	7	7

Scenario			Factors				Responses								
Context	Case	Description	Time of Day				A1	B1	B2	C1	C2	D1	E1	F1	F2
Your agency chose to deploy WEA to issue public alerts 6 months ago. The system is fully functional, and through training and practice you are fully capable of issuing alerts. Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event ...	@ 10:30 AM	… that occurs at 10:30 AM ?	0				7	7	7	7	7	6	6	7	7
	@ 2:30 AM	… that occurs at 2:30 AM ?	1				7	7	7	7	7	6	6	6	7

Appendix Z Alert Originator Trust Model Validation Survey

Wireless Emergency Alerting Trust Model

Thank you for agreeing to participate in our research regarding the Wireless Emergency Alerting (WEA) service. Your assistance is greatly appreciated.

Background

The SEI has been tasked by DHS Science and Technology Division to facilitate the adoption of the FEMA WEA service by emergency management agencies (EMAs).

For EMAs to adopt and use WEA, they must be confident that WEA will perform as planned – that it will accept the alerts that they create and disseminate them to the public in a timely and accurate fashion. EMAs must trust WEA to enhance public safety. Absent this trust, EMAs are unlikely to make the effort to adopt and use WEA.

A part of the SEI's task for DHS is to study this issue of trust. In support of this task, we are building a "WEA Trust Model" that will model the interactions between the alert originators, the WEA service, and the public to predict alert originators' willingness to use WEA to issue public alerts. Once completed, this model will enable us to identify actions that alert originators can apply to maximize both their trust in WEA, as well as the public's trust in WEA It will also identify actions to avoid a decrease in trust. In this manner, it will provide guidance for alert originators to aid them in maximizing the effectiveness of WEA.

This model considers many factors influencing trust; such as:

- WEA performance on prior alerts - were the alerts disseminated accurately to the proper geographic areas in a timely manner
- Public response to prior alerts – has feedback from the public indicated that they value the WEA alerts
- Ease of use – can alert originators create and send alerts with a reasonable amount of effort

The SEI is surveying a large number of EMAs to identify the impact of these factors. Your agency has probably already received a request to participate in this survey, and we would value your responses. Based on the results of the survey, the SEI will build and calibrate the trust model. However, that is not the end of the task.

To be of value, a model must provide a reasonable representation of reality. In order to validate the usefulness and accuracy of our model, we must compare its results with actual scenarios from emergency managers. To accomplish this validation, we request that you provide your responses to the following scenarios. We will submit these same scenarios to the trust model. By comparing the model's responses to yours, we can determine how accurately our model is performing

This questionnaire

This questionnaire contains seven simplistic scenarios regarding the use of WEA for public alerting. Each scenario addresses several factors that we believe influence trust. Each scenario explores various combinations of trust factors as noted below:

Scenario	Trust factors
1:	training, cybersecurity, and governance
2:	feedback from prior alerts, public awareness, and alert frequency
3:	availability, accessibility, reliability, and ease of use
4:	timeliness of dissemination, message understandability, and accuracy
5:	urgency, severity, and certainty
6	geographic breadth
7:	time of day

For example, the first scenario addresses training, cybersecurity, and governance factors. The scenario presents four cases identifying different combinations of these factors

- Case 1: Sufficient training, sufficient cybersecurity, insufficient governance
- Case 2: Sufficient training, insufficient cybersecurity issues, sufficient governance
- Case 3: Insufficient training, sufficient cybersecurity issues, sufficient governance
- Case 4: Insufficient training, insufficient cybersecurity issues, insufficient governance

Our analysis examines these permutations to extract the influence of each of the factors.

For each of the cases of each of the scenarios, we ask that you indicate the likelihood of using the WEA service to issue public alerts.

TRUST MODEL VALIDATION SCENARIOS

Scenario 1. ***This set of scenarios probes the impact of training, cybersecurity, and governance on your choice to use WEA.***

Your agency chose to deploy WEA to issue public alerts 16 months ago. The system is fully functional and, through training and practice you are fully capable of issuing alerts.

Thunderstorms have been occurring across your city for the past 24 hours. NWS has responsibility for generating alerts for weather-related events, and has issued an alert for flash flooding of several low-lying areas within the city.

You receive reliable and confirmed information that a dam break on the Little Bear reservoir is imminent. This will result in major flooding downstream.

For each case below, please indicate how likely you are to use WEA to issue a public alert under the stated circumstances?

Case 1: sufficient training, sufficient cybersecurity, insufficient governance

You have been fully trained on the use of WEA, and understand both the principles behind WEA and the operation of the alerting software used in your agency. You have successfully practiced issuing alerts with your alerting software. You have templates for alerts that can be applied to this event.

Over the past 12 months, no cybersecurity breaches of the WEA service (e.g., access by unauthorized personnel, issuance of false alerts) have occurred in your agency, and none have been reported by other agencies

You have an agreement with the local NWS office regarding the division of responsibilities for alerting. This agreement clearly defines that NWS will issue alerts for all weather related emergencies, and your agency will issue alerts for all other imminent threats. However, since the imminent dam break is the result of the on-going thunderstorms, you are unsure of your responsibility for issuing an alert for this threat.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 2: sufficient training, insufficient cybersecurity, sufficient governance

You have been fully trained on the use of WEA, and understand both the principles behind WEA and the operation of the alerting software used in your agency. You have successfully practiced issuing alerts with your alerting software. You have templates for alerts that can be applied to this event.

Over the past 12 months, several cybersecurity breaches of the WEA service (e.g., access by unauthorized personnel, issuance of false alerts) have occurred in your agency, and others have been reported by other agencies.

You have an agreement with the local NWS office regarding the division of responsibilities for alerting. This agreement clearly defines that NWS will issue alerts for all weather related emergencies, and your agency will issue alerts for all other imminent threats. Since the imminent dam break is not a weather event, you are sure of your responsibility for issuing an alert for this threat.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 3: insufficient training, sufficient cybersecurity, sufficient governance

You have not been fully trained on the use of WEA, and have only a basic understanding of both the principles behind WEA and the operation of the alerting software used in your agency. You have not had opportunities to practice issuing alerts with your alerting software. You do not have templates for alerts that can be applied to this event.

Over the past 12 months, no cybersecurity breaches of the WEA service (e.g., access by unauthorized personnel, issuance of false alerts) have occurred in your agency, and none have been reported by other agencies

You have an agreement with the local NWS office regarding the division of responsibilities for alerting. This agreement clearly defines that NWS will issue alerts for all weather related emergencies, and your agency will issue alerts for all other imminent threats. Since the imminent dam break is not a weather event, you are sure of your responsibility for issuing an alert for this threat.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 4: insufficient training, insufficient cybersecurity, insufficient governance

You have not been fully trained on the use of WEA, and have only a basic understanding of both the principles behind WEA and the operation of the alerting software used in your agency. You have not had opportunities to practice issuing alerts with your alerting software. You do not have templates for alerts that can be applied to this event.

Over the past 12 months, several cybersecurity breaches of the WEA service (e.g., access by unauthorized personnel, issuance of false alerts) have occurred in your agency, and others have been reported by other agencies.

You have an agreement with the local NWS office regarding the division of responsibilities for alerting. This agreement clearly defines that NWS will issue alerts for all weather related emergencies, and your agency will issue alerts for all other imminent threats. However, since the imminent dam break is the result of the on-going thunderstorms, you are unsure of your responsibility for issuing an alert for this threat.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Scenario 2. ***This set of scenarios probes the impact of <u>feedback from prior alerts</u>, <u>public awareness</u>, and <u>alert frequency</u> on your choice to use WEA.***

Your agency chose to deploy WEA to issue public alerts 6 months ago. The system is fully functional, and through training and practice you are fully capable of issuing alerts.

For each case below, please indicate how likely you are to use WEA to issue a public alert for an imminent threat under the stated circumstances?

Case 1: favorable feedback, public outreach, many prior alerts

The public has responded to prior alerts with calls to 9-1-1 operators, and calls and emails to the EMA, the mayor, and the city council. 47% of the callers expressed questions about the WEA service (e.g., what is this service? What should I do? Why am I getting these alerts? How does WEA know where I am?), <u>42% expressed appreciation for the alerts</u> received, and 11% objected to receiving the alerts.

Prior to deploying WEA, <u>your agency performed public outreach</u> via TV, radio, and newspapers to inform the public about the upcoming alerting service.

Within your jurisdiction over the past 6 months, the NWS has used WEA to issue <u>48 weather-related (e.g., tornadoes, thunderstorms) alerts.</u> No AMBER alerts have been issued. Your agency has issued <u>18 alerts for various imminent threats</u> (e.g., police actions, chemical spills, structure fires).

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 2: favorable feedback, no public outreach, few prior alerts

The public has responded to prior alerts with calls to 9-1-1 operators, and calls and emails to the EMA, the mayor, and the city council. 47% of the callers expressed questions about the WEA service (e.g., what is this service? What should I do? Why am I getting these alerts? How does WEA know where I am?), <u>42% expressed appreciation for the alerts</u> received, and 11% objected to receiving the alerts. <u>Your agency has not performed public outreach</u> via TV, radio, and newspapers to inform the public about the WEA service. Within your jurisdiction over the past 6 months, the NWS has used WEA to issue <u>8 weather-related (e.g., tornadoes, snowstorms) alerts</u>. No AMBER alerts have been issued. Your agency has issued <u>3 alerts for imminent threats</u> - one for a police action (armed standoff), one for a chemical spill, and one for a fire requiring a 4 square block evacuation.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 3: unfavorable feedback, public outreach, few prior alerts

The public has responded to prior alerts with calls to 9-1-1 operators, and calls and emails to the EMA, the mayor, and the city council. 47% of the callers expressed questions about the WEA service (e.g., what is this service? What should I do? Why am I getting these alerts? How does WEA know where I am?), 11% expressed appreciation for the alerts received, and <u>42% objected to receiving the alerts</u>. Prior to deploying WEA, <u>your agency performed public outreach</u> via TV, radio, and newspapers to inform the public about the WEA service. Within your jurisdiction over the past 6 months, the NWS has used WEA to issue <u>8 weather-related (e.g., tornadoes, snowstorms) alerts</u>. No AMBER alerts have been issued. Your agency has issued <u>3 alerts for imminent threats</u> - one for a police action (armed standoff), one for a chemical spill, and one for a fire requiring a 4 square block evacuation.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 4: unfavorable feedback, no public outreach, many prior alerts

The public has responded to prior alerts with calls to 9-1-1 operators, and calls and emails to the EMA, the mayor, and the city council. 47% of the callers expressed questions about the WEA service (e.g., what is this service? What should I do? Why am I getting these alerts? How does WEA know where I am?), 11% expressed appreciation for the alerts received, and 42% objected to receiving the alerts. Your agency has not performed public outreach via TV, radio, and newspapers to inform the public about the WEA service. Within your jurisdiction over the past 6 months, the NWS has used WEA to issue 48 weather-related (e.g., tornadoes, thunderstorms) alerts. No AMBER alerts have been issued. Your agency has issued 18 alerts for various imminent threats (e.g., police actions, chemical spills, structure fires).

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Scenario 3. ***This set of scenarios probes the impact of <u>availability</u>, <u>accessibility</u>, <u>reliability</u>, and <u>ease of use</u> on your choice to use WEA.***

Your agency chose to deploy WEA to issue public alerts 6 months ago. The system is fully functional, and through training and practice you are fully capable of issuing alerts.

For each case below, please indicate how likely you are to use WEA to issue a public alert for an imminent threat under the stated circumstances.

Case 1: high availability, high accessibility, high reliability, easy to use

Over the past 12 months, the WEA service has been down for maintenance approximately <u>1 hour per year.</u>

WEA alerts can be generated and <u>issued from your office or from your smart phone</u> using a secure app that interfaces to your alert generation software.

Your alerting software and the WEA service <u>successfully transmits 99.9% of alerts</u> that are correctly configured and entered.

The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately <u>5 minutes of effort.</u>

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 2: high availability, high accessibility, low reliability, difficult to use

Over the past 12 months, the WEA service has been down for maintenance approximately 1 hour per year.

WEA alerts can be generated and issued from your office or from your smart phone using a secure app that interfaces to your alert generation software.

Your alerting software and the WEA service successfully transmits 90% of alerts that are correctly configured and entered.

The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately 40 minutes of effort.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 3: high availability, low accessibility, high reliability, difficult to use

Over the past 12 months, the WEA service has been down for maintenance approximately 1 hour per year.

WEA alerts can be generated and issued only from a dedicated terminal within your agency's central office.

Your alerting software and the WEA service successfully transmits 99.9% of alerts that are correctly configured and entered.

The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately 40 minutes of effort.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 4: high availability, low accessibility, low reliability, easy to use

Over the past 12 months, the WEA service has been down for maintenance approximately 1 hour per year.

WEA alerts can be generated and issued only from a dedicated terminal within your agency's central office.

Your alerting software and the WEA service successfully transmits 90% of alerts that are correctly configured and entered.

The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately 5 minutes of effort.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 5: low availability, high accessibility, high reliability, difficult to use

Over the past 12 months, the WEA service has been down for maintenance approximately 1 hour per week.

WEA alerts can be generated and issued from your office or from your smart phone using a secure app that interfaces to your alert generation software.

Your alerting software and the WEA service successfully transmits 99.9% of alerts that are correctly configured and entered.

The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately 40 minutes of effort.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 6: low availability, high accessibility, low reliability, easy to use

Over the past 12 months, the WEA service has be down for maintenance approximately <u>1 hour per week</u> WEA alerts can be generated and <u>issued from your office or from your smart phone</u> using a secure app that interfaces to your alert generation software. Your alerting software and the WEA service <u>successfully transmits 90% of alerts</u> that are correctly configured and entered. The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately <u>5 minutes of effort.</u>

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 7: low availability, low accessibility, high reliability, easy to use

Over the past 12 months, the WEA service has be down for maintenance approximately <u>1 hour per week.</u> WEA alerts can be generated and <u>issued only from a dedicated terminal within your agency's central office</u> Your alerting software and the WEA service <u>successfully transmits 99.9% of alerts</u> that are correctly configured and entered. The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately <u>5 minutes of effort.</u>

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 8: low availability, low accessibility, low reliability, difficult to use

Over the past 12 months, the WEA service has be down for maintenance approximately 1 hour per week. WEA alerts can be generated and issued only from a dedicated terminal within your agency's central office. Your alerting software and the WEA service successfully transmits 90% of alerts that are correctly configured and entered. The process of using your alerting software to create and send an alert to IPAWS-OPEN requires approximately 40 minutes of effort.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Scenario 4. ***This set of scenarios probes the impact of <u>timeliness of dissemination</u>, <u>message understandability</u>, and <u>accuracy</u> on your choice to use WEA.***

Your agency chose to deploy WEA to issue public alerts 6 months ago. The system is fully functional, and through training and practice you are fully capable of issuing alerts.

For each case below, please indicate how likely you are to use WEA to issue a public alert for an imminent threat under the stated circumstances.

Case 1: rapid dissemination, high understandability, low accuracy

Prior messages have been <u>distributed within 2 minutes</u> of your submitting the WEA data input.

You can craft any message of your choosing with a <u>maximum size of 270 characters.</u>

Prior WEA messages sent to IPAWS-OPEN have been disseminated with <u>significant errors in the message data</u> (errors that affect the understandability or content of the message).

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 2: rapid dissemination, low understandability, high accuracy

Prior messages have been <u>distributed within 2 minutes</u> of your submitting the WEA data input.

You are able to issue only <u>“standardized” messages</u> developed by the WEA service based on your CAP (Common Alerting Protocol) inputs. In other words, you may not tailor the message.

Prior WEA messages sent to IPAWS-OPEN have been disseminated with <u>no errors in the message data.</u>

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 3: slow dissemination, high understandability, high accuracy

Prior messages have been distributed within 10 to 30 minutes of your submitting the WEA data input. You can craft any message of your choosing with a maximum size of 270 characters. Prior WEA messages sent to IPAWS-OPEN have been disseminated with no errors in the message data.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 4: slow dissemination, low understandability, low accuracy

Prior messages have been distributed within 10 to 30 minutes of your submitting the WEA data input. You are able to issue only "standardized" messages developed by the WEA service based on your CAP (Common Alerting Protocol) inputs. In other words, you may not tailor the message. Prior WEA messages sent to IPAWS-OPEN have been disseminated with significant errors in the message data (errors that affect the understandability or content of the message).

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Scenario 5. This set of scenarios probes the impact of <u>urgency</u>, <u>severity</u>, and <u>certainty</u> on your choice to use WEA.

Your agency chose to deploy WEA to issue public alerts 6 months ago. The system is fully functional, and through training and practice you are fully capable of issuing alerts.

For each case below, please indicate how likely you are to use WEA to issue a public alert for an imminent threat under the stated circumstances.

Case 1: high urgency, high severity, low certainty

For an event that requires public action within <u>10 minutes</u>.

For an event that poses <u>extraordinary threat to life.</u>

For a severe and urgent event that is <u>30% likely</u> to occur.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 2: high urgency, low severity, high certainty

For an event that requires public action within <u>10 minutes</u>.

For an event that poses <u>possible threat to property.</u>

For a severe and urgent event that is <u>90% likely</u> to occur.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 3: low urgency, high severity, high certainty

For an event that requires public action within 2 hours.

For an event that poses extraordinary threat to life.

For a severe and urgent event that is 90% likely to occur.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Case 4: low urgency, low severity, low certainty

For an event that requires public action within 2 hours.

For an event that poses possible threat to property.

For a severe and urgent event that is 30% likely to occur.

How likely are you to use WEA to issue a public alert under the circumstances stated above? *(Please choose one)*

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Scenario 6. This set of scenarios probes the impact of the <u>geographic breadth</u> of an event on your choice to use WEA.

Your agency chose to deploy WEA to issue public alerts 6 months ago. The system is fully functional, and through training and practice you are fully capable of issuing alerts.

Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event ...

… where <u>30%</u> of the alert recipients are in the hazard zone and <u>70%</u> are outside the zone?

Please choose one:

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

… where <u>90%</u> of the alert recipients are in the hazard zone and <u>10%</u> are outside the zone?

Please choose one:

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Scenario 7. ***This set of scenarios probes the impact of the <u>time of day</u> of an event on your choice to use WEA.***

Your agency chose to deploy WEA to issue public alerts 6 months ago. The system is fully functional, and through training and practice you are fully capable of issuing alerts.

Do you think WEA would be an appropriate tool to issue a public alert for a severe and urgent event ...

… that occurs at <u>10:30 AM</u> ?

Please choose one:

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

… that occurs at <u>2:30 AM</u> ?

Please choose one:

☐	☐	☐	☐	☐	☐	☐
Definitely Not (<5%)	Very Probably Not (5-20%)	Probably Not (20-40%)	Maybe (40-60%)	Probably (60-80%)	Very Probably (80-95%)	Definitely (>95%)

Appendix AA Alert Originator Trust Model Validation Graphical Results

Scenario 1

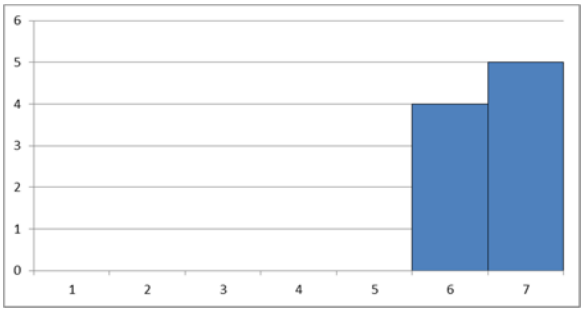

Figure 108: Case 1: Sufficient Training, Sufficient Cybersecurity, and Insufficient Governance

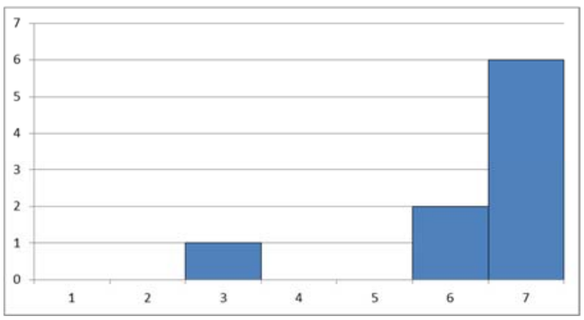

Figure 109: Case 2: Sufficient Training, Insufficient Cybersecurity, and Sufficient Governance

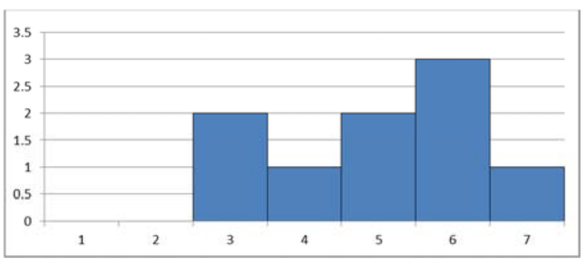

Figure 110: Case 3: Insufficient Training, Sufficient Cybersecurity, and Sufficient Governance

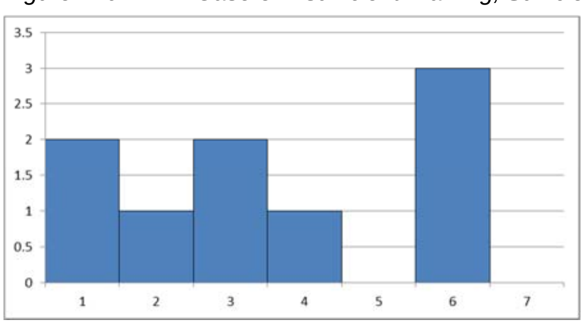

Figure 111: Case 4: Insufficient Training, Insufficient Cybersecurity, and Insufficient Governance

Scenario 2

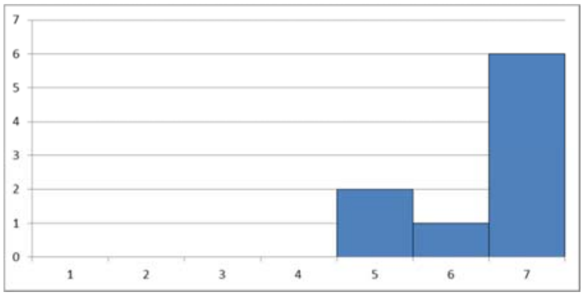

Figure 112: Case 1: Favorable Feedback, Public Outreach, and Many Prior Alerts

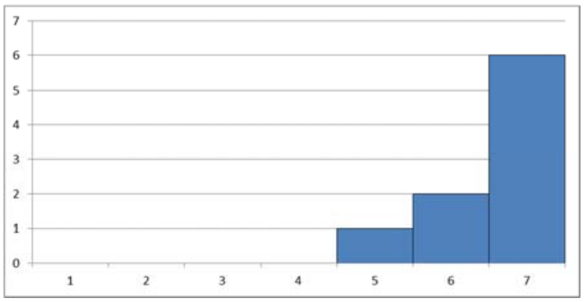

Figure 113: Case 2: Favorable Feedback, No Public Outreach, and Few Prior Alerts

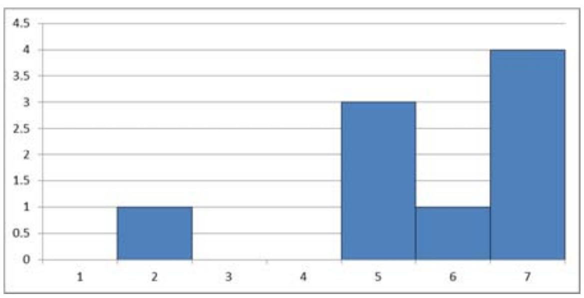

Figure 114: Case 3: Unfavorable Feedback, Public Outreach, and Few Prior Alerts

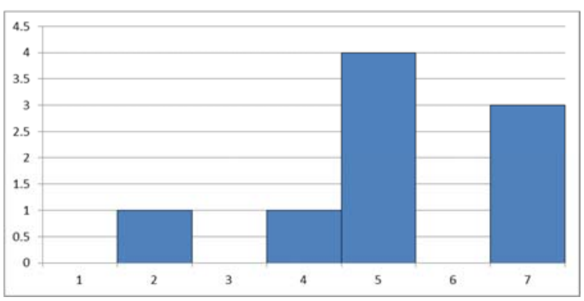

Figure 115: Case 4: Unfavorable Feedback, No Public Outreach, and Many Prior Alerts

Scenario 3

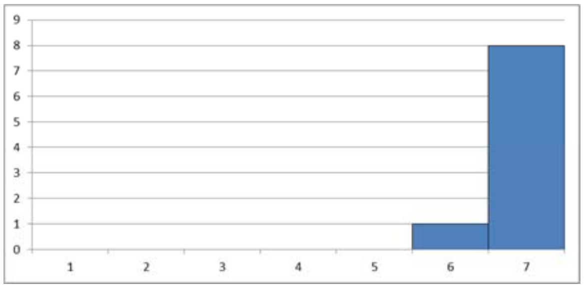

Figure 116: Case 1: High Availability, High Accessibility, High Reliability, and Easy to Use

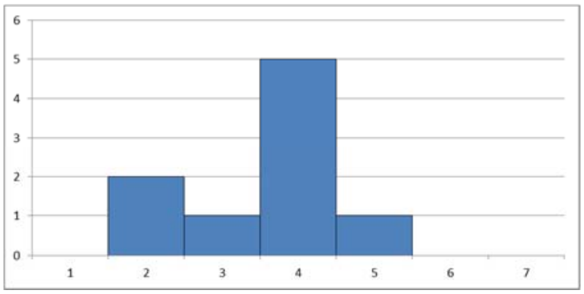

Figure 117: Case 2: High Availability, High Accessibility, Low Reliability, and Difficult to Use

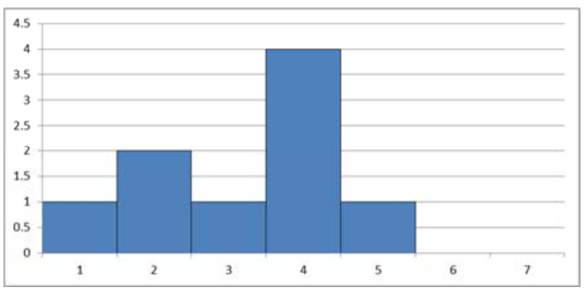

Figure 118: Case 3: High Availability, Low Accessibility, High Reliability, and Difficult to Use

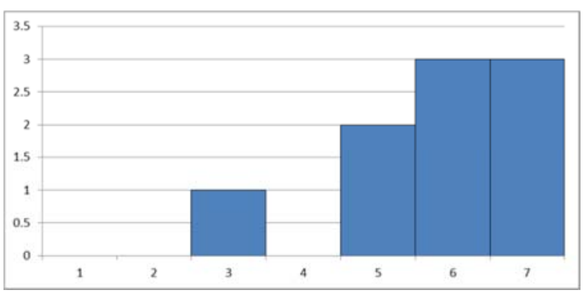

Figure 119: Case 4: High Availability, Low Accessibility, Low Reliability, and Easy to Use

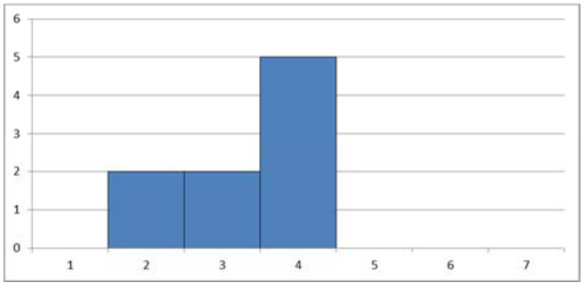

Figure 120: Case 5: Low Availability, High Accessibility, High Reliability, and Difficult to Use

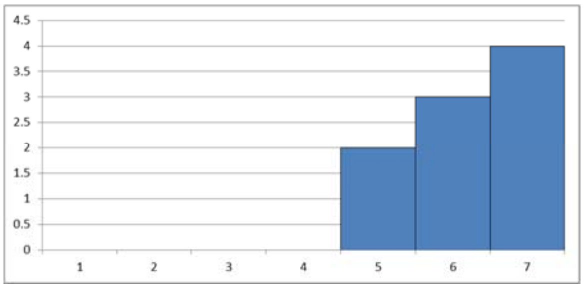

Figure 121: Case 6: Low Availability, High Accessibility, Low Reliability, and Easy to Use

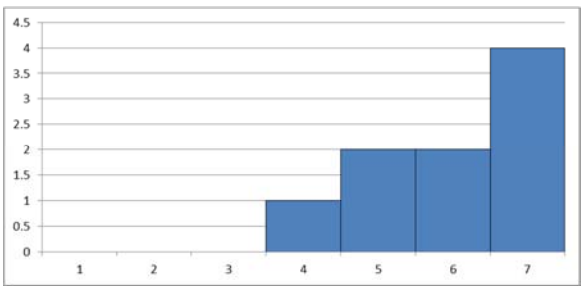

Figure 122: Case 7: Low Availability, Low Accessibility, High Reliability, and Easy to Use

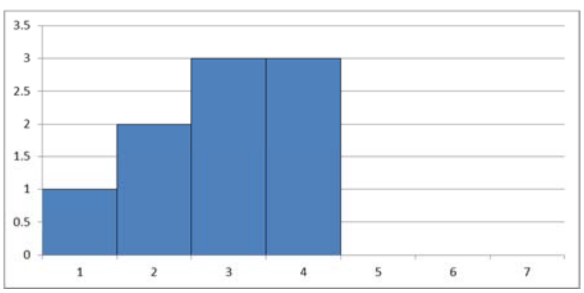

Figure 123: Case 8: Low Availability, Low Accessibility, Low Reliability, and Difficult to Use

Scenario 4

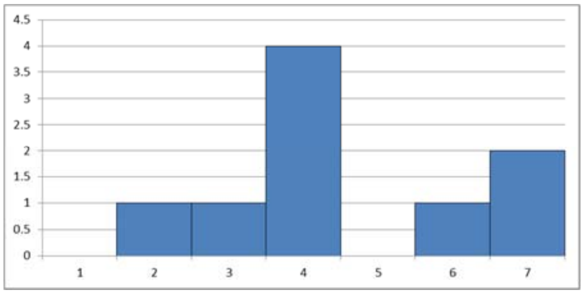

Figure 124: Case 1: Rapid Dissemination, High Understandability, and Low Accuracy

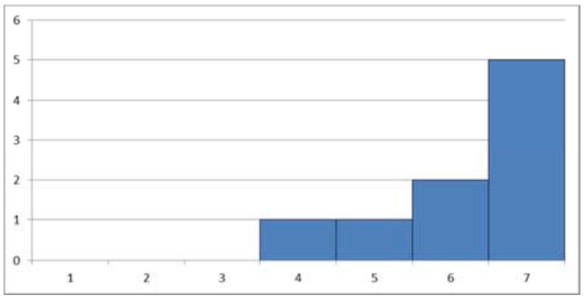

Figure 125: Case 2: Rapid Dissemination, Low Understandability, and High Accuracy

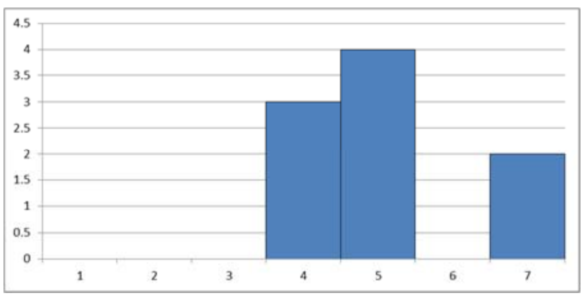

Figure 126: Case 3: Slow Dissemination, High Understandability, and High Accuracy

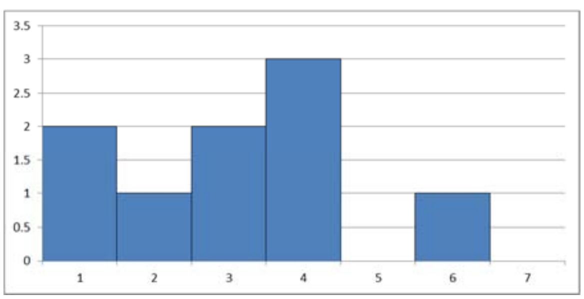

Figure 127: Case 4: Slow Dissemination, Low Understandability, and Low Accuracy

Scenario 5

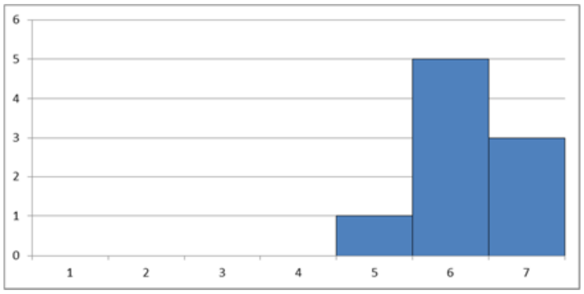

Figure 128: *Case 1: High Urgency, High Severity, and Low Certainty*

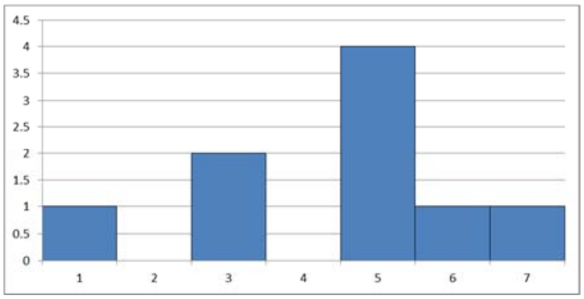

Figure 129: *Case 2: High Urgency, Low Severity, and High Certainty*

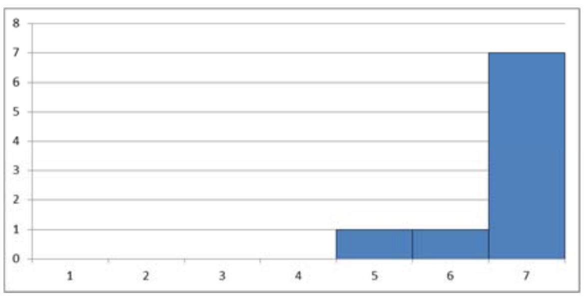

Figure 130: *Case 3: Low Urgency, High Severity, and High Certainty*

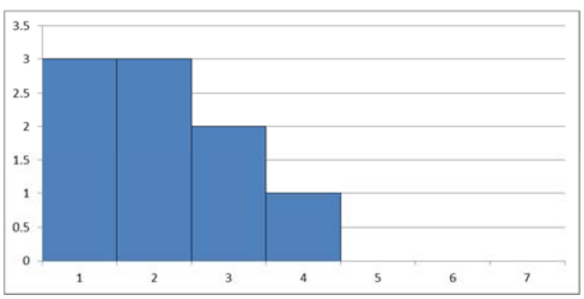

Figure 131: *Case 4: Low Urgency, Low Severity, and Low Certainty*

Scenario 6

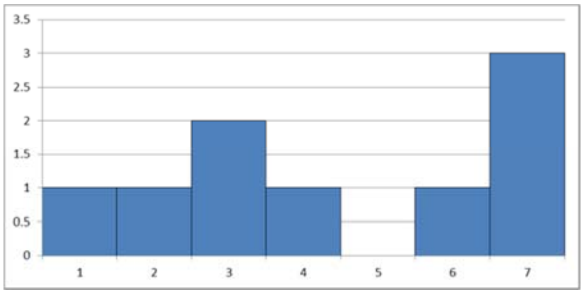

Figure 132: Case 1: Small Event and Large Alert

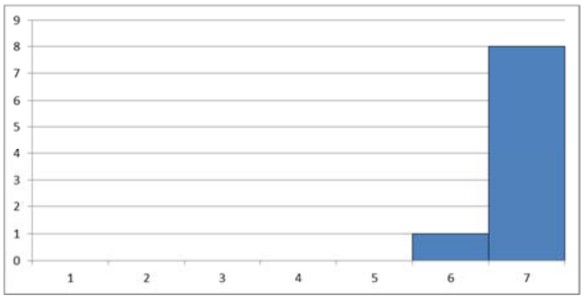

Figure 133: Case 2: Large Event and Large Alert

Scenario 7

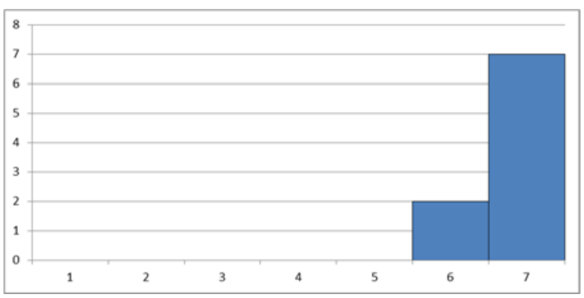

Figure 134: Case 1: 10:30 a.m.

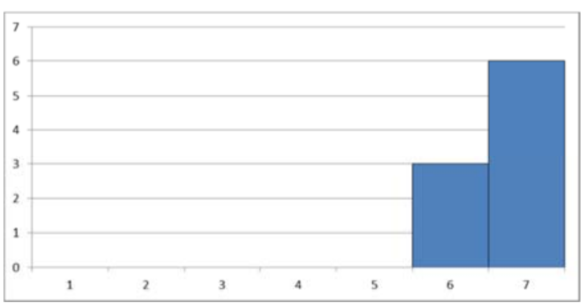

Figure 135: Case 2: 2:30 a.m.

Appendix AB Alert Originator Trust Model Validation Statistical Analysis

Table 80: Validation of AO BBN Model Against Results of AO Validation Scenario Interviews

Scenario	Validation Score from Validation Interviews	BBN Prediction of Scenario	Outcome of Interest	BBN Utilization Prediction	BBN Available Prediction	BBN Effective Prediction	BBN Appropriate Prediction
1	98	40	Utilization	40	73	69	71
2	98	37	Utilization	37	69	69	72
3	70	40	Utilization	40	73	69	72
4	30	36	Utilization	36	68	69	71
5	98	39	Utilization	39	71	69	72
6	98	39	Utilization	39	71	69	72
7	70	38	Utilization	38	71	68	72
8	70	38	Utilization	38	71	67	72
9	98	41	Utilization	41	74	69	72
10	50	39	Utilization	39	71	69	72
11	50	36	Utilization	36	68	69	72
12	88	39	Utilization	39	72	69	72
13	50	39	Utilization	39	71	69	72
14	88	41	Utilization	41	74	69	72
15	88	39	Utilization	39	72	69	72
16	30	36	Utilization	36	68	69	72
17	50	37	Utilization	37	71	66	72
18	98	39	Utilization	39	71	69	72
19	70	39	Utilization	39	71	69	72
20	30	35	Utilization	35	71	63	72
21	88	39	Utilization	39	71	69	72
22	70	40	Utilization	40	71	69	73
23	98	40	Utilization	40	71	69	73
24	13	34	Utilization	34	71	69	65

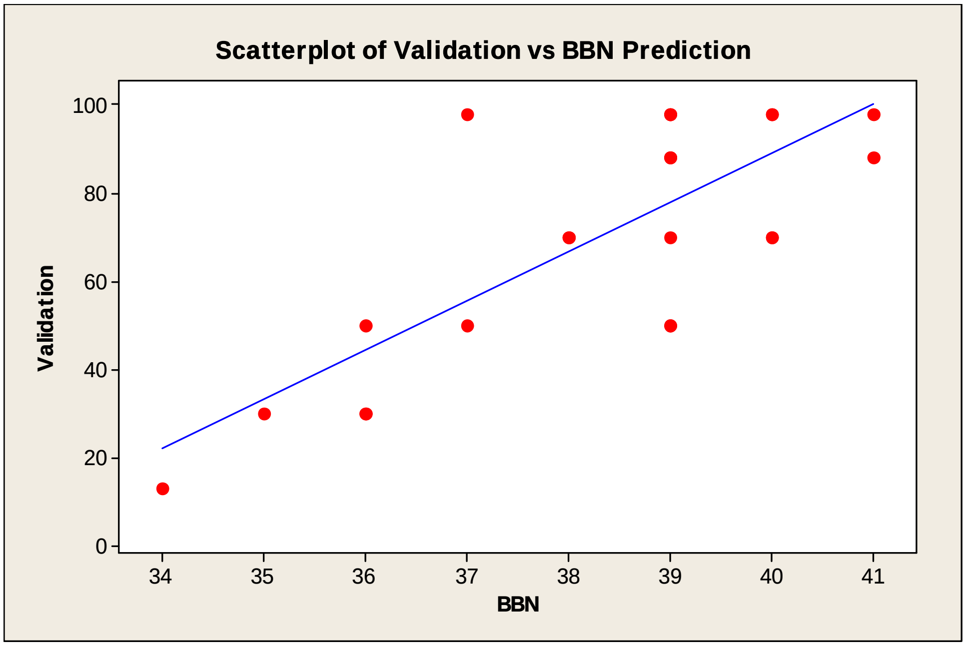

Figure 136: Analysis of All Predictions Across All Outcome Nodes in Table 80

Regression Analysis: Validation vs. BBN

The regression equation is Validation = –357 + 11.1 BBN.

Table 81: Regression Coefficient Results for Validation vs. BBN

Predictor	Coef	*SE* Coef	*t*	*p*
Constant	-356.85	74.46	-4.79	0.000
BBN	11.147	1.940	5.75	0.000

S = 17.2814, R-Sq = 60.0%, R-Sq(adj) = 58.2%

Table 82: Analysis of Variance for Validation vs. BBN

Source	*df*	*SS*	*MS*	*F*	*p*
Regression	1	9857.7	9857.7	33.01	0.000
Residual error	22	6570.2	298.6		
Total	23	16428.0			

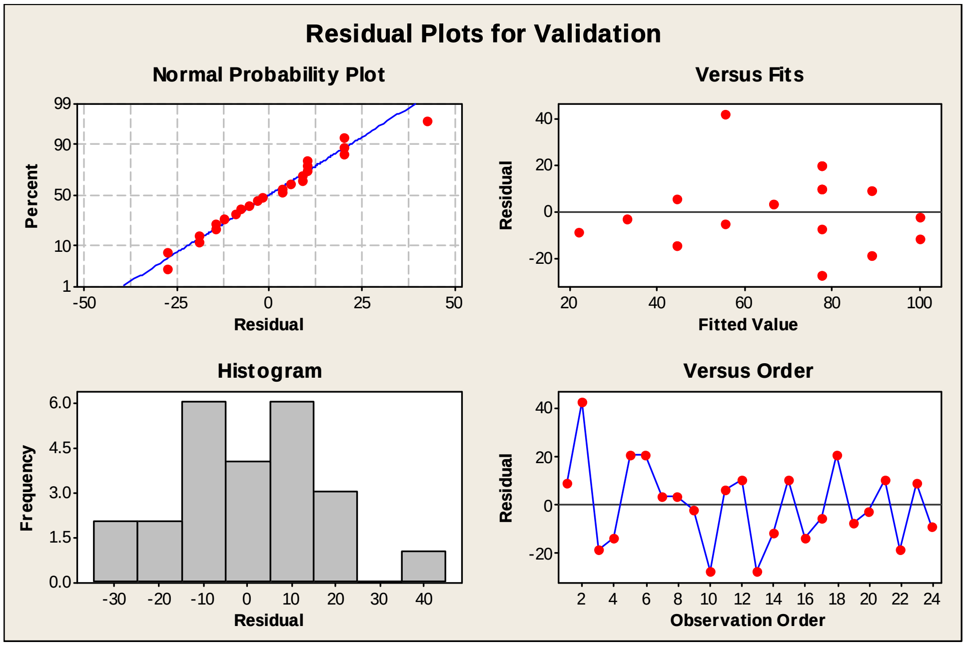

Figure 137: Residual Plots for Regression of Overall Validation as Function of BBN Predictions

Appendix AC AgenaRisk Tool Configuration Settings

During the course of the probabilistic trust modeling and simulation using AgenaRisk, we identified a number of configuration settings as sensitive to proper model operation and simulation. Here we provide settings, warnings, and guidance that we deem critical to reproducing and running the WEA trust models within AgenaRisk.

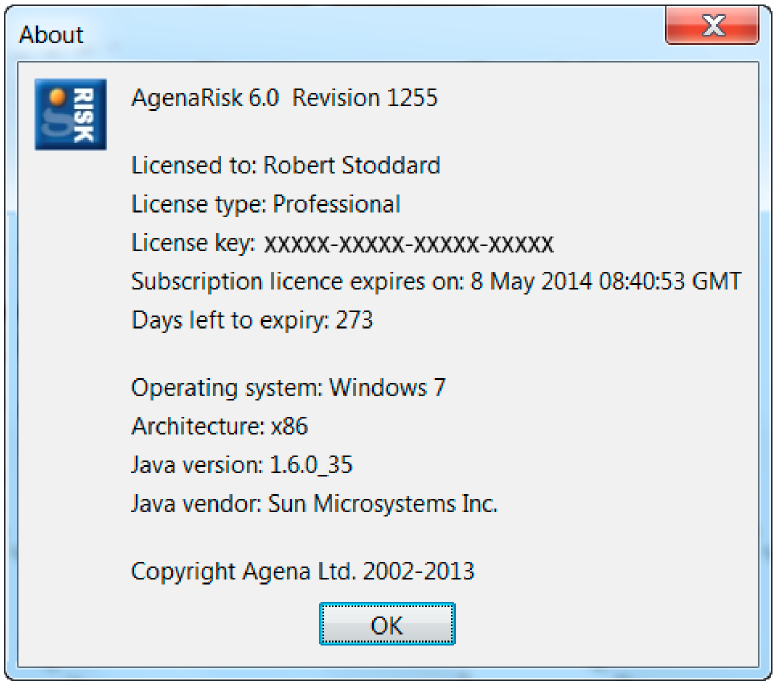

Figure 138: Version of AgenaRisk Used for This Project

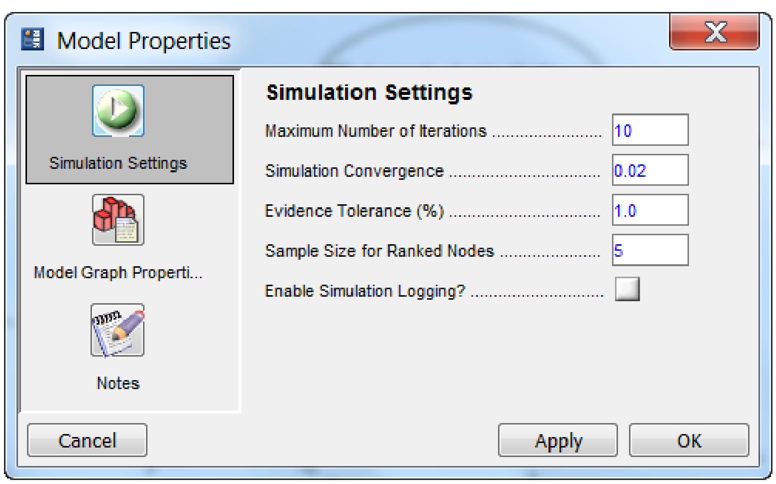

Figure 139: Simulations Settings Used for the Public and AO Trust Models

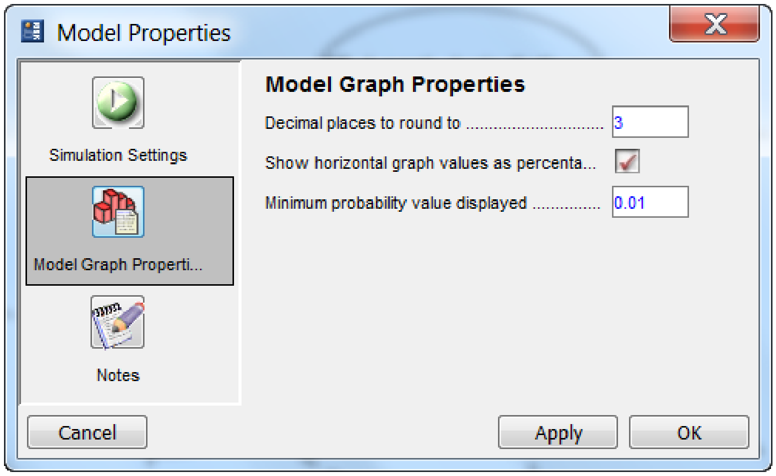

Figure 140: Model Graph Properties Used for the Public and AO Trust Models

We initially encountered some problems related to the Java runtime executable (JRE) size of the AgenaRisk models during simulation. Often, the simulation would fail when the JRE exceeded 1 GB. As a result, we used the following JRE settings associated with the 32-bit Windows installation of AgenaRisk. We altered the runtime parameters via **Control Panel** > **Programs** > **Java (32 bit)** > **Java** > **View**, as shown in Figure 141, to accommodate larger JRE sizes.

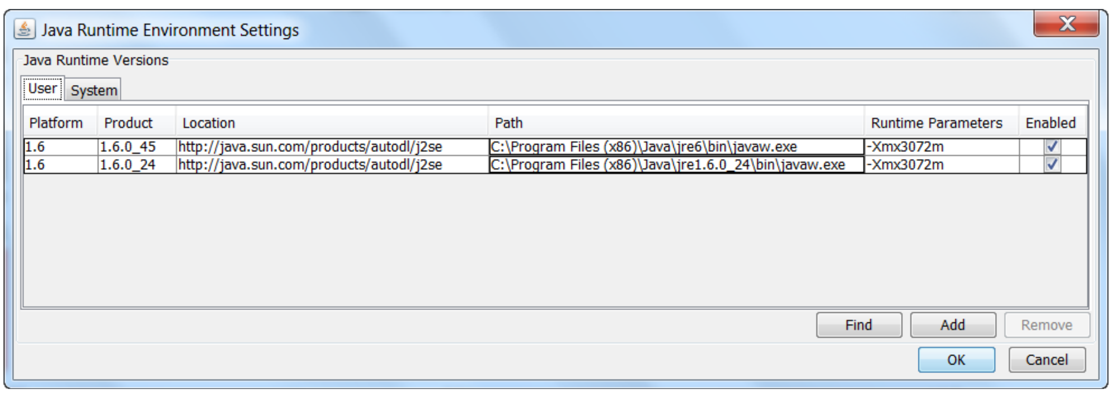

Figure 141: Altering Runtime Parameters to Handle Large JRE Sizes

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13. ABSTRACT (MAXIMUM 200 WORDS) Trust is a key factor in the effectiveness of the Wireless Emergency Alerts (WEA) service. Alert originators (AOs) must trust WEA to deliver alerts to the public in an accurate and timely manner. Members of the public must also trust the WEA service before they will act on the alerts that they receive. This research aimed to develop a trust model to enable the Federal Emergency Management Agency (FEMA) to maximize the effectiveness of WEA and provide guidance for AOs that would support them in using WEA in a manner that maximizes public safety. The research method included Bayesian belief networks to model trust in WEA because they enable reasoning about and modeling of uncertainty. The research approach was to build models that could predict the levels of AO trust and public trust in specific scenarios, validate these models using data collected from AOs and the public, and execute simulations on these models for numerous scenarios to identify recommendations to AOs and FEMA for actions to take that increase trust and actions to avoid that decrease trust. This report describes the process used to develop and validate the trust models and the resulting structure and functionality of the models.			
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